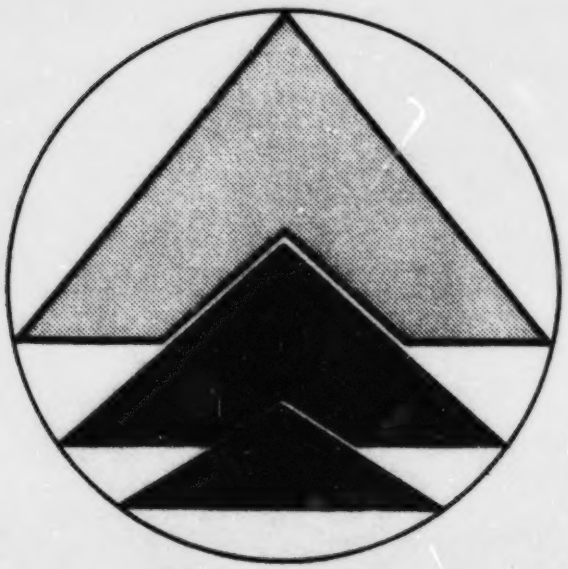
PROSPECTUS

FOR AN ALBERTA CONSERVATION STRATEGY



PUBLIC ADVISORY COMMITTEES
TO THE
ENVIRONMENT COUNCIL
OF ALBERTA

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December 5, 1985

PUBLIC ADVISORY COMMITTEES TO THE ENVIRONMENT COUNCIL OF ALBERTA

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PREFACE

The World Conservation Strategy (WCS) was commissioned by the United Nations Environment Programme (UNEP), which together with the World Wildlife Fund provided the financial support for its preparation and contributed to the development of its basic themes and structure. After five years of intensive worldwide effort, the WCS document was prepared and published by the International Union for Conservation of Nature and Natural Resources (IUCN) in 1980. Preparation for the WCS document was characterized by extensive discussions, reviews, and heated debate among the widest possible audience in the international sphere. The World Bank, numerous national governments, development agencies, international aid organizations, non-government environmental groups, the sponsoring agencies, and many scientists assisted in the development of the final product. In all, over 450 government agencies, conservation organizations in over 100 countries, and more than 700 scientists and other experts participated.

Many Canadians were directly involved in the preparation of the Strategy. The executive director of the IUCN at the time was Dr. David Munro, a resident of British Columbia who is now acting as information coordinator for the development of provincial strategies across Canada.

The World Conservation Strategy was initiated in response to perceptions that there is a global problem with regard to the sustainable utilization of resources, primarily renewable resources. The increasing frequency with which species are becoming extinct or endangered, the desertification of large areas of the globe, and increasing population pressures on dwindling resources of all kinds led many people to conclude that a global perspective is needed to meet the challenges of the remainder of the 20th Century and beyond.

Many people believe that the "developed world" cannot preach to or cajole less affluent nations to look after their physical environment unless the affluent countries are operating on a sustainable yield basis themselves. Leading by example may be more than just good foreign policy in this case; it may be essential for our future well-being as a species.

But simply taking a global perspective is not enough. In order to accomplish something tangible, a more regional view is needed. The World Conservation Strategy provides a framework within which more localized strategies can be formulated. Over 40 nations have produced or are in the process of developing a national conservation strategy.

In October of 1981 the Government of Canada endorsed the World Conservation Strategy through the Minister of the Environment. The endorsement took place after a thorough review of the principles contained in the WCS document and the policies of our federal government. At the time, 22 actions were recommended to adjust federal activities to bring them more in line with the priorities and principles of the World Conservation Strategy. One of the actions recommended was to encourage the preparation of Provincial Conservation Strategies. This document is the first step in developing a Conservation Strategy for Alberta.

ACKNOWLEDGEMENTS

We would like to acknowledge the contribution to our own work made by the authors of the World Conservation Strategy. That document provides a superb context for the development of an Alberta Conservation Strategy. It stands as a guiding light for nations all around the world, illuminating global environmental degradation, and pointing the way in practical terms for a new course towards rational, pragmatic development for the people of the world and this planet we hold so dear. It is by no means a perfect document, but it is a solid foundation and framework for national, provincial, and local governments to build upon to suit their particular situations.

We would also like to acknowledge the contribution to this document of the fine work of the New Zealand Nature Conservation Council and the Australian National Conservation Strategy Task Force within the Commonwealth Department of Home Affairs. Much of our present document has been patterned after and, in some cases, borrowed from their documents.

Special recognition should also be given to the efforts of Mr. Elmer Kure of Innisfail, Alberta. It was through his quiet yet persistent work that the Advisory Committees to the Environment Council came to recognize the significance of the World Conservation Strategy, and began to work towards developing a Conservation Strategy for Alberta. Twelve people were selected from among 150 Advisory Committee Members to form a Steering Committee for developing a Strategy for Alberta.

Committee Members:	Representing:
Joan Snyder, Chairperson	Renewable Resources Study Group
Elmer Kure, Vice-Chairperson	Renewable Resources Study Group
Dorothy Broadbent, Member	Environment Protection Study Group
Maryhelen Posey, Member	Renewable Resources Study Group
Bob Richardson, Member	Environment Protection Study Group
Brian Alleyne, Member	Pollution Study Group
Bill Buchta, Member	Non-Renewable Resources Study Group
Bill Flook, Member	Urban Environment Study Group
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INTRODUCTION: WHAT WE HOPE TO ACCOMPLISH WITH THIS PROSPECTUS

> "Human beings, in their quest for economic development and enjoyment of the riches of nature, must come to terms with the reality of resource limitation and the carrying capacities of ecosystems, and must take account of the needs of future generations."

With these words, the World Conservation Strategy began an excursion into the arena of global ideas and conflict. During the intervening five years, something remarkable has happened. The words and ideas contained in the 55-page document have struck a chord of agreement within the minds and hearts of people and governments all over the world. Nations as diverse in social, economic, cultural, environmental, and political character as Australia and the People's Republic of China have somehow reached the common conclusion that the underlying principles and concepts of the World Conservation Strategy are well suited to their respective situations in the late 1980s. Why has this happened? How can it be that people, apparently so very different in nearly every respect, are suddenly subscribing to a similar world view?

This document will attempt to answer these questions by describing the basic principles of the World Conservation Strategy, and the world view that is the foundation for its structure. The concepts are not difficult; their very simplicity is a major reason for the broad support for them. The World Conservation Strategy is about practical ideas. It deals with the shared values and commonly held beliefs that nearly all people know to be true. A few of these ideas may consist of "motherhood" statements and platitudes, but most are practical ideas presenting each of us with some rather challenging judgments to make about our future. The World Conservation Strategy deals with some real world issues that are among the most troublesome our species has ever faced, and it doesn't even mention war. It is about the resources of this planet and the way we make use of them. It is about the human carrying capacity of this earth, and the quality of life, which we must consider in determining carrying capacity. Most of all, it is about tradeoffs and calculated risks.

This document, called a Prospectus, has three distinct purposes:

1) to provide the necessary background for considering a Conservation Strategy for Alberta, by discussing the World Conservation Strategy, on which an Alberta Strategy would be based;

2) to stimulate discussion about the merits and weaknesses of the major underlying principles of a Conservation Strategy by describing these principles in detail;

3) to describe in general terms the objectives that should be established for an Alberta Conservation Strategy.

It is intended that this document should provide the reader with sufficient information to decide whether a Conservation Strategy for Alberta ought to be developed according to the format suggested. This Prospectus provides only the basic ideas to keep in mind during the long process of developing a Conservation Strategy for Alberta. It does not constitute a Conservation Strategy itself.

In essence, a conservation strategy is a framework that provides direction for the sustainable use and management of resources for the benefit of all. A Provincial Conservation Strategy would involve consideration of the present and future needs and goals of Albertans, the institutional capabilities of the province, and the status of our natural resources. It would provide an opportunity for us to chart our course, to identify objectives and options for our future. In general, it is a strategy for conservation rather than preservation, although in some cases resource preservation is also necessary to ensure sustainable use in the long term.

A number of conservation strategies have been developed in various parts of the world, but every one has certain functions:

- to establish conservation goals;

- to determine the requirements for achieving these conservation goals while at the same time accomodating development objectives;
- to establish priorities for these goals using the criteria of significance, urgency, and irreversibility;
- to identify the obstacles to meeting these goals;
- to analyze present and planned mechanisms for dealing with the obstacles;
- to propose the most cost-effective, least disruptive, and most thoroughly integrated methods for overcoming those obstacles;
- to derive a plan of action for implementing the agreed-upon methods;
- to provide a means for a continuing evaluation of our goals, of progress toward achieving them, and of the least-cost solutions.

These steps towards developing a Conservation Strategy will require the maximum possible participation and commitment of government agencies, industry, interest groups, and the people of Alberta. The process used for preparation of a Conservation Strategy document will determine the value of the final product. This Prospectus is merely an assemblage of some of the central ideas necessary for the next step.

The first chapter of the Prospectus discusses some of the principles upon which the World Conservation Strategy is based. Then the important linkages between the ideas of development and conservation are described. Finally, the objectives of an Alberta Conservation Strategy are outlined, and the need for a Strategy is discussed. In chapter two the physical setting of Alberta is presented, and the Province's history and present characteristics are described. Chapter three includes some in-depth discussion of the six primary objectives that would be found in an Alberta Conservation Strategy. This provides the background necessary for evaluating the need for an Alberta Conservation Strategy. The concluding chapter deals with the future: where we go from here. It asks the reader to

respond by suggesting to the Public Advisory Committees which issues should be emphasized in the development of an Alberta Conservation Strategy.

The federal government of Canada endorsed the principles of the World Conservation Strategy in 1981. But the political structure of our country puts the responsibility for most of the resources, both renewable and non-renewable, squarely on the shoulders of the provinces. For this reason, it is imperative that the World Conservation Strategy be examined by the people of Alberta and the government that represents them. We need to determine whether some of these ideas might be useful for our own purposes and, if so, which ones, and to what extent the principles of the World Conservation Strategy should be endorsed and applied. Alberta is not alone in this endeavor. Groups in five other provinces are also actively pursuing Conservation Strategies for their provinces. Each of the four remaining provinces and both territories are monitoring the progress towards provincial conservation strategies.

This Prospectus has been prepared by the Advisory Committees to the Environment Council of Alberta. These committees consist of representatives from over 100 different organizations in Alberta, ranging from the Alberta Wilderness Association to the Urban Development Institute, as well as unaffiliated but equally dedicated individuals. The diversity of opinion among the people on the three committees may be as broad as that of the people of the province at large, but the common interest of the membership is environmental matters. Thus there is a strong emphasis on the environment in all the committees' projects. The World Conservation Strategy is fundamentally an environmental document, and the Advisory Committees feel it necessary to advance the principles contained in it by means of this Prospectus.

The Advisory Committees are prepared to begin developing an Alberta Conservation Strategy with the support and participation of the Alberta public. The intent is to incorporate those ideas and

principles from the World Conservation Strategy that are appropriate to Alberta into a Strategy agreeable to the people of this province. During preparation of a draft Conservation Strategy for Alberta, extensive public consultation should take place, through the Advisory Committees, the organizations the members represent, and through other means to document the comments of the public at large. Surveys, solicitation of written comments, and public hearings are potential avenues for further development and refinement of a Conservation Strategy for Alberta.

It is obvious that such a Strategy could not be effective without the endorsement of the Government of Alberta. At some point in the development of the Strategy document, agencies of the provincial government should be directly involved in preparing and reviewing portions of the Strategy, and providing advice and assistance to those involved. We hope that the sound principles and complete lack of ideology or partisan political intent in the Strategy can motivate a government formed by <u>any</u> political party to wholeheartedly endorse and support an Alberta Conservation Strategy.

WHY WE NEED A CONSERVATION STRATEGY

The Nature of Our Natural Resources

"Natural resources and the environment constitute the ultimate foundation upon which all future economic activity must be constructed. From this it follows that future economic progress...will be increasingly dependent on the sustained integrity of the resource and environmental base" (Hamrin 1983: 1). Historians have pointed out the role of resource depletion in the decline of numerous civilizations throughout history. But it is becoming clear that we do not need to examine ancient history to discover the existence of this pattern. Nor do we need to look beyond our borders to find the wrenching human problems stemming from resource depletion, or what is essentially the same thing, lack of competitive production and processing.

Single-industry towns dependent on the long-term economic competitiveness of one resource seem invariably to reach distressing circumstances. In our province we can think about the survival of small agriculture-based based communities, the importance of coal mining to Grande Cache, and the off-again on-again development of the Bonnyville-Cold Lake region. The nature of our resource base may make this kind of development inevitable, but it is important for the people of this province that we continue on the path towards balanced and sustainable development. An Alberta Conservation Strategy would provide guidelines to help us progress beyond the starting point of our basic natural resources.

In discussing the need for a transition to a renewable resource based economy, it is important that we agree on the meaning of "renewable resource." For humans, all resources are considered to be resources only if they are available for our use at a cost we are willing to pay. This means that for practical purposes the "renewability" of a resource is a matter of socio-economics rather than a consequence of being biological (Kimmins 1985). People generally think of resources as renewable if they are alive, are created by

living things, or are renewed by the normal operations of the solar system and the earth. Agriculturally productive topsoil, clean rivers, forests, and fisheries are all considered renewable. In fact, all of these are only potentially renewable from the perspective of human use.

Non-renewable resources are those resources that, by virtue of the amounts of time, energy, or money that would be required to renew them, will not be replenished, at least by us. For example, oil and coal are, over the long term, renewable resources since the biological and geological processes that create them continue today. However, practically speaking these resources are non-renewable because it takes far too long for new oil and coal to be formed to be useful to us today or in the foreseeable future. We could make oil and coal if we applied enough technology and energy to the appropriate organic materials, but the cost would be far higher than the benefit received. Thus truly renewable resources are those that regenerate themselves, with or without our help, at the speed we require and with energy inputs we can afford.

The importance of this definition should not be underestimated. It is easy to mistake a resource that is theoretically renewable for one that is economically renewable. This might lead a person or society to invest in seemingly renewable resources that are not viable over the long term (and perhaps not in the short term). If a resource requires a continuing external support from society worth more than the return from the resource, it should not be considered renewable. Society may choose to subsidize a process of net loss for good reasons, but if a great deal of money is involved, to avoid bankruptcy in the long run society must make the process self-supporting, find a substitute, or abandon the effort.

Examples from parts of the world that have supported human habitation for much longer than North America can be instructive. Huge areas of land in Africa have for practical purposes become deserts due to human use of the land at a greater than sustainable rate. The productivity of this land deteriorated at a rate faster than biological

processes could replenish it, the human managers could not or did not intervene to reverse the degradation, and, as an agricultural resource, the land became non-renewable in an economic sense. The land is still theoretically capable of producing vast amounts of food, but only if the society chooses to invest vast amounts of money in a recovery program and has that money to invest.

Our civilization and life itself, in the final analysis, depend on the sustainable use of our resources: fertile soil, water, clean air, sunlight, which in combination with climate, topography, and location produce the many living resources vital to our existence. Add to this mix the human dimension, and we have the primary basis for our life here in Alberta: the agricultural industry, the forest products industry, coal, oil, natural gas, oil sands, tourism, and the multi-faceted service industries that both serve and enhance the value of the production industries. An Alberta Conservation Strategy would have as its core, these fundamental realities.

The World View of the World Conservation Strategy

The Conservation Strategy does not depend on any ideology for its justification. Elaborate philosophical discussions are not necessary to understand what it says. The political or economic system prevalent in the nation is not especially relevant to the validity of the principles contained in the document. The particular culture or even religion of various nationalities has little to do with the acceptance of the ideas put forth. Even the location on the planet is not of special significance to the principles of the Conservation Strategy. About the only belief one needs to hold in order to understand the Conservation Strategy is this: that the material world around us has a bearing on what we are and what we will become, and that our actions can change parts of the material world. Put another way, we need water to drink, food to eat, clothing and shelter to keep harmful things like cold and sunburn away, and we need some form of "economic development" to provide these things. Only when we have some of these bare

essentials looked after in a moderately satisfactory way are we able to concern ourselves with our "higher needs" and how to improve the quality of our lives.

Paradoxically, it seems that only by attaining some of our higher needs are we able to improve our ability to look after basic needs in less time and with less work. We make these improvements by taking the time to apply our intelligence to problems, and then deciding how to use available resources to solve our problems. In a nutshell, we need time to think. One of the great advantages we have over other species is that we not only have the ability to think, we have the time to think.

Consider the grizzly bear. His life is largely filled with the endless task of finding and consuming enough edible plants and animals to provide the energy he needs for further searching and eating. Even if he was self-aware and intelligent to the point of attempting to order his world, he would somehow have to free himself from the eternal search for food and shelter. Economic development, defined broadly, is what has freed some humans to pursue and improve the quality of life. Quality of life and economic development are inextricably connected. Many people would argue that economic development began with the mastery of fire, sharpened sticks for warding off predators, and recognition of appropriate plants for food. Without economic development there would be no education to make us aware of the options we think of when we speak of "quality of life," let alone the potential to turn those options into reality. There would be no ability to care for our sick and elderly, poor sanitation, few books, little travel, and short lives spent concerned with the same things that concern the grizzly. In short, resources are the basis for economic development, and economic development is essential to our well-being and quality of life. By the same token, an improved quality of life preconditions further economic development.

Values, attitudes, awareness, and priorities establish what kind of society and economy we shall have. How we individually and

collectively view the world and our place in it has a lot to do with our success in dealing with it. When we understand it correctly, the world sometimes rewards us by sharing some of its bounty. When we misunderstand it or misuse it, it sometimes provides what economists call "disincentives;" that is, it wipes us out. Fortunately for us, the real world is often quite flexible and forgiving in its reactions to our intrusions.

The intent of a Conservation Strategy is not to change society's values or attitudes, but to rearrange some of the priorities that result from our values. What it is intended to do is provide a sounding board for people to make explicit what we usually do not think about or discuss in our everyday lives. These things are often thought of as "common sense" or "obvious." But these principles are too often forgotten when some of our more complex, difficult, and important decisions are made. The very complexity of our contemporary world can hide the simple principles that provide some guidance about how we should deal with difficult decisions. Some of these simple principles are:

1. KEEP YOUR OPTIONS OPEN. People have become a major force for change on the earth, with the power to affect the biosphere radically in a very short time span. Human activities are daily causing extinctions in many parts of the world. At the same time, other people are bringing into being entirely new living things through the rapidly expanding field of biotechnology. In spite of our power to modify the earth and the living creatures on it, we are not immune to both the intended and unintended consequences of our actions. The ability to improve our world is balanced by an equal ability to do harm. As biotechnology matures as a science, more and different genetic materials will become necessary for further developments. It is impossible to predict which species or local variant could prove indispensible in the future. Everything from a cancer cure to crops better suited to our dry northern climate may be contained in the genetic material

of an endangered species. Closing off some of our options for the future through thoughtless extinctions today is irrational, especially since we may be poised on the threshold of understanding.

2. INTEGRATE AS MUCH INFORMATION AS POSSIBLE IN PLANNING AND MANAGING RESOURCES. Nearly everyone has a favorite example of some company, government, or person devising a logical and precise plan for achieving a particular goal and subsequently finding out that exactly the opposite resulted because of some seemingly unrelated circumstance that had everything to do with the plan. When related responsibilities are compartmentalized, cross purposes usually result. It has cynically been said that most new government programs are simply an attempt to correct the unexpected results of a previous government program. Everything in the world is in one way or another connected to everything else.

   It is not possible to integrate all factors into any given decision, but we now have in place a vast storehouse of knowledge about environmental and economic effects and interactions. The main reason so much information goes unused is this: it has become so compartmentalized that most of it is unavailable to people making important decisions with vast interconnected webs of effects. At a time when so much is being made of the emerging information-based society and economy, it behooves us to try harder to integrate information from as many informed sources as possible. There are many applications of new technology that could be used for improving integrated management.

3. ENSURE THAT THE USE OF RESOURCES IS SUSTAINABLE. Using our resources in a sustainable manner is akin to spending the interest while keeping the capital. An individual or society that spends the capital rather than investing and living on

the interest will sooner or later run out of funds altogether. The idea here is that of carrying capacity: how many, at what level of consumption, for how long are the relevant questions.

Carrying capacity can be thought of as a ceiling, or upper limit, on the sizes of populations that an environment can support over the long term. It is a property of neither organisms nor the environment, but of their interaction. The carrying capacity is determined by one or more factors, which may differ among species; as well, it can vary with time and can be influenced by the genetic capabilities of individuals to respond to environmental factors. When the upper limit of population size is reached, the sustaining power of the factor(s) determining carrying capacity will be just enough to support the population. In other words, the controlling factor in shortest supply at a particular time sets the carrying capacity of an environment. Such factors might include food and water supplies, nesting sites, predators, hiding places, and so on.

Ultimately, it is carrying capacity that governs the density of all living things, including humans. Most environments are sufficiently "forgiving" that if the population increases slightly beyond this ceiling for a short time, no permanent damage will result. However, prolonged periods above this often unknown yet critical limit imposed by the environment will result in collapse of the sustaining resource, followed by a reduction in population(s) that depend on the resource. To date, most such experiences have been relatively local in nature, but that does not diminish their significance or their message.

The task of determining the number of organisms a given environment can support in a sustainable fashion is very difficult, and one of the many reasons for this difficulty is

related to the rate of growth in populations and in their use of resources. At some point in their growth, populations usually go through a logarithmic, or exponential, phase; eventually, though, they tend to reach a point where the numbers are in balance with the supporting environment (that is, the carrying capacity). However, predicting the numbers at which this will occur is the difficult part.

On a global basis, human populations and resource use have been increasing exponentially for some time. Exponential growth is characterized by doubling, and only a few doublings quickly produce huge numbers. We can see the results of exponential growth in savings accounts that pay compound interest, and in the erosion of our purchasing power due to inflation. For example, if inflation were six percent per year, in 70 years, prices would have risen by a factor of about 64; the $0.90 loaf of bread eaten by today's toddlers would cost them $57 as pensioners. However, if the inflation rate were just four percent per year, the same loaf in 70 years would cost only $14. A seemingly small difference in growth rate of just two percent per year has enormous long-term implications for sustainable resource use.

People are often thought to be capable of extending resources, and thus carrying capacity by the application of intelligence. This comes about as a result of our inventing substitutes for a depleting resource, or discovering new ways to extract more, or finding new quantities of the resource in places we hadn't looked before, usually in more remote locations. It is hard to dispute that we as a species have been able to increase dramatically the number of people presently relying on the carrying capacity of our planet. There may be some dispute, however, concerning the ability of our technology to sustain this number as our new carrying capacity.

Sustainable use of resources means treating Alberta as if we plan to stay. Maintaining the productivity of our agricultural soils, ensuring that forest regeneration is proceeding at the same pace as harvesting, establishing and enforcing fishing regulations, preventing overuse of critical areas for wildlife survival, maintaining clean water to drink and clean healthy air to breathe are all matters of sustainable use.

An idea similar to sustainable use can also be applied to our non-renewable resources. Though we cannot indefinitely sustain our use of oil, gas, and coal resources, there are in place a wide variety of mechanisms to prevent a too rapid depletion and to invest wisely the capital that is being generated through their use. The use of non-renewable resources can be viewed as assisting economic sustainability if the revenues are used to develop sustainable resources that might otherwise be impossible to develop, which will enable our society to sustain itself indefinitely. Anything less than than this level of reinvestment would be exceeding the carrying capacity of our resources by not stretching this capacity while expending our capital of non-renewable resources. It would be a kind of liquidation sale. Of course, our human resources should be considered one of the best sustainable resources available to us, and appropriate investments in this area often have a high return. In fact, this resource preconditions the sustainability of all others. The level of education, training, and experience of our population has much to do with our ability to sustain ourselves.

One of the problems with ensuring sustainable resource development is that the perception of the time period necessary for sustainability differs for different decision makers. For example, society's planning horizon should be longer than that of the corporation. Even the most

optimistic investor would probably admit that his or her corporation may not last quite as long as humanity. More importantly, the decision makers within the corporation are not acting with indefinite time scales in mind. Corporate managers are under great pressure to show profits this year, not in the next decade. By discounting the future at a higher rate, a manager may insure his or her future by showing immediate results (profits), but may at the same time be insuring a rocky road for the corporation's future. Few corporations can withstand net losses for very long, and for managers the period of grace is usually short. Thus the corporate "sustainable" is sometimes shorter in duration than the best interests of society.

The personal definition of "sustainable" may involve an even shorter time period. People with substantial financial commitments to family and home may reckon their sustainability in weeks. This is of course one of the reasons for government. But governments too may sometimes plan for shorter periods than society as a whole might find optimal. In the pleasant circumstance of democracy, it becomes the citizen's responsibility to ensure the government is acting in the long term best interests of the society. It is the citizen who has old age to worry about and it is the citizen who has children for whom a sustainable heritage is essential. Thus it is the ordinary person, you and I, who must be concerned about sustainable development in our personal lives, our jobs and business interests, our community, our province, and our nation.

4. WHERE POSSIBLE ENCOURAGE RENEWABLE RESOURCE DEVELOPMENT OVER EXHAUSTIBLE NON-RENEWABLE DEVELOPMENT. This idea does not imply that renewable resources are inherently superior. A resource is theoretically renewable if it can be renewed whether or not it requires an external input of other

resources. However, as the saying goes you cannot eat theory. For practical purposes, a resource is renewable only if it is capable of regeneration without excessive (to the point of being uneconomic) human help. Taking a purely hypothetical case, if it costs $300 per acre to reforest a particular area that was worth only $10 per acre to harvest, and it takes 80 years before another $10 may be obtained from it, we are dealing with a non-renewable resource. Under this socio-economic definition, the truly renewable resource is clearly the preferred choice, when such a choice is available.

Strictly defined, the only non-renewable resource is energy. Many other resources (such as metals) may be economically non-renewable, but are potentially recyclable. Energy, on the other hand, can only be used once, and the dissipation of energy into a less available form is an irreversible process. The Second Law of Thermodynamics, sometimes referred to as the Entropy Law, was originally derived specifically in relation to energy. Entropy refers to the continuous process of degradation of matter and energy in the universe towards an ultimate state of uniform immobility. This principle has been generalized by some ecologists and bioeconomists, and applied to the practice of conservation and economic growth.

> "This is the law of moth and rust, the law of aging and decay. It is the Second law of thermodynamics. It can be generalized as the great Second Law: If anything happens it is because it had a potential for happening that overcame the resistance to its happening, and once it has happened that potential has been used up. Thinking of the law in terms of the diminution of potential rather than the increase in entropy gives it great generality at a certain cost in precision, which I am more than willing to pay" (Boulding 1977: 280-281).

In effect, the concept of entropy places limitations upon what is ultimately possible because of the inevitable and constant loss of total available energy.

5. MAKE SURE YOU KNOW THE EXTENT OF YOUR AGREEMENT BEFORE YOU BEGIN DISAGREEING. It is not the intent of the Conservation Strategy to mislead anyone by trying to deny the reality of conflict. There are significant differences in the way people perceive and value the world around them. We should all acknowledge the fact that conflict will always, thankfully, be with us. Only through conflict and its resolution in the open forum of reasoned discussion and debate can we achieve the balance and wisdom necessary to sustain the various needs of our pluralistic society.

   But before the parties to a disagreement go into high gear on behalf of their cause, they should each carefully consider what the other is really saying. It is pointless and wasteful of valuable time and money to perpetuate a conflict on the basis of mutual misunderstanding. This is especially true when both sides to a conflict interpret the other's argument through an ideological filter instead of facing up to the more difficult job of dealing with the facts behind the argument. We should all be careful not to waste any of society's resources in a debate based on some simple misunderstanding.

6. WHEN CONSIDERING SOLUTIONS TO PROBLEMS, FOCUS ON CAUSES AS WELL AS SYMPTOMS, AND MIX CURE WITH PREVENTION. It is often easier to identify and treat the symptoms of ecological problems rather than dig deeper to find the cause. In many cases the causes of particular problems are well known, but the symptoms are so acute that immediate action is required. However, reacting to or dealing with only the symptoms is ineffective in the long term. Left untreated, the causes of the symptoms may gradually erode our ability to deal with either.

Existing problems are sometimes so serious that it is tempting to focus all our attention on them. But impending problems could be even worse unless they are anticipated and early action is taken to prevent them. A successful strategy should be a careful combination of curing current problems while at the same time equipping people and government to anticipate and avoid future problems. Continuous crisis management is a proven management technique for failure. A Conservation Strategy does not include a crystal ball, but the planning process necessary for developing the Strategy will assist all parties in clarifying the present situation, evaluating our future prospects, and anticipating some of the difficulties ahead. An early warning well heeded can prevent crises, and save the resources that would otherwise have to be spent in dealing with them.

The Relationship of Development to Conservation

Development is the modification of the biosphere (the thin covering of the planet that contains and sustains life) and the application of human, financial, living, and non-living resources to satisfy human needs and improve the quality of human life. Conservation is the management of the human use of the biosphere to yield the greatest sustainable benefits to present generations while maintaining the potential to meet the needs and aspirations of this and future generations.

Development and conservation are the complementary elements of a single two-part idea: that humans are capable of transforming portions of the material world to better suit their needs, and thus to live fuller, more productive, happier, healthier, and longer lives - and that this transformed world can be sustained to enable generations of humans to continue on Earth. Live better today through development based on conservation yesterday, and live better tomorrow through conservation supported by development today. Naturally, the two

concepts can be separated in our minds, but in the real world, they are as inseparable as the two sides of a coin. In our contemporary usage of the words we have allowed the linkage to be misplaced. In many people's minds the two words "development" and "conservation" have become so separated they have come to mean opposites. Our language has come to be divisive when it should be conciliatory.

This is part of what the Provincial Conservation Strategy must address, a reconciliation of words. So many phrases and buzzwords have been invented by "developers" and "conservationists" in our language alone that significant barriers to defining the common ground in our beliefs are caused by the quick reaction of each group to the image-laden expressions of those they assume oppose their ideas. This is often based simply on the slogan each hears from the other. These slogans, expressions, and sometimes single words act like triggers firing attitudinal cotton batting into the ears of those hearing them. Once either side hears the trigger words, emotions are aroused and all meaningful exchange seems to stop. If neither side will listen carefully to what the other side is saying, we are unlikely to reach satisfactory resolutions to our conflicts. More to the point, we may not even recognize when we are agreeing on the essentials and are simply saying similar things differently. This sort of misunderstanding can have tragic consequences for human relations, and on a more personal level, human relationships.

The reintegration of conservation and development as a single idea can save much unnecessary turmoil when changes to our environment are under consideration. Putting conservation into the development equation after the plans have been made and the blueprints drawn, and while the project approvals are being processed, though always necessary, should not be considered an adequate substitute for consideration at the planning and policy stage. By the time the project stage is reached, the usually large commitment of time and money means that environmental damage is only mitigated and conservation programs are piecemeal or fragmentary. If a bold decision is made to stop a project at a late stage because environmental costs

are too high, major confrontations ensue between the vested interests from both sides. The results are inevitably unnecessary social conflict (sometimes neighbor against neighbor), wasted time, and high cost. These millions of dollars and hundreds of talented people could be much better used in developments determined ahead of time to be in keeping with mutually agreed upon principles of conservation and development. Conflicts will always be with us, but by integrative planning we may be able to avoid some, and deal with the rest more effectively for the benefit of all.

The World Conservation Strategy is not unique in its endeavor to bridge the gap between conservation and development. The past few years have seen many people from diverse fields of study and every sector of industry directing more attention to the need for an integrated approach in the planning stages of any development. Many industry leaders and environmental public interest groups have for years been finding that they agree on more issues than they expected. Statements such as "when we searched far enough into the facts, we discovered again and again that we really didn't need to disagree" are becoming more common as conservationists and business people begin to spend more time listening and talking directly to one another. Another frequently heard theme goes like this:

> "we all need more and better allies to get the job done, because just as achievement of the conservation agenda will require business commitment and leadership, so also will environmental support be required to achieve the business agenda" (Gilbreath 1984).

Integrating development with conservation is much more than a semantic transformation. It is an important step towards improving both business and environmental decision-making. There is and will continue to be a need to reduce the time now spent reconciling conflicts among public objectives, and this requires setting more priorities in advance. A Conservation Strategy for Alberta can help do this and thus reduce the red tape and friction between public groups, government, and industry by laying a foundation for integrative

planning and action in an atmosphere of mutual respect and, eventually, trust.

Energy Prices, High Tech, and Efficiency

The emergence of high technology as a revolutionary force in the economy of every nation has come at a time when the world is becoming increasingly interdependent with respect to trade, interest rates, energy sources, monetary policy, and currencies. This creates an intensely competitive atmosphere. We must now do more with less in order to stay even. Conservation is an idea whose time has come not because of moral suasion, but because the reality of the world makes it necessary!

The increasing cost of finding, extracting, processing, transporting, manufacturing, transporting again, and disposing of mineral resources has provided a powerful incentive to conserve. What regulation and moral arguments failed to achieve, simple economic realities have quickly brought about. Effective new competition from formerly underdeveloped nations has spurred economic efficiencies in nearly every sector of our economy. The slogan "Conservation is Good Business" no longer needs saying. One example of conservation in action is the remarkable statistic that industrial production in the United States reached an all-time high in 1984, while the use of steel (including all domestic and imported) was down by 20 percent from the previous high in 1973. Estimates are that the 1984 consumption of oil in the United States may also have been down considerably from the previous high in 1978.

This is clearly a case of an economy responding to market signals that indicated energy costs were increasing at a higher rate than the cost of other inputs. Another indicator is the fact that "sunset" industries (those declining relative to the economy as a whole, and expected to be in permanent decline) are nearly all non-renewable resource industries concentrated in mining and processing raw material. The enormous expansion in financial service type industries, financial

publications, and financial programming on television and radio is simply a recognition that conservation of finances is vitally important.

Efficiency has become the key word of the Eighties, and it is being attained by information and by the application of new technologies. Both emphasize conservation as the first step towards economic efficiency. Use less, make it quicker, make it lighter, and make it durable in order to beat the competition. This trend is tied to the physics of our material world, and to an economic system that is based largely on physical principles. Under conditions of high-cost energy, making and moving lots of big things around is inefficient and thus costly compared to moving fewer smaller things. If energy costs begin to move down relative to other input costs, conservation in the sense described may become less important, but the lessons learned during the "energy crisis" will not be forgotten. The expectation of high energy costs, as much as the actual present cost, will determine how energy is treated as an input factor. No one wants to get caught in another squeeze due to an unrealistic reliance on cheap energy, such as happened during the oil shocks of 1973 and 1979. Regardless of the cost of energy, the principles of fewer and lighter versus more and heavier remain the same. For example, the physics of electronic mail do not bode well for the postal system as we know it.

Canada is said to be the most trade-dependent nation in the world. Within this country, Alberta must surely be among the provinces most dependent on international trade. Our exports of oil, natural gas, petrochemicals, coal, forest products, grain, and livestock are the foundation of our economy. Even our tourist industry is based upon the provision of services and experiences for the export market. The intensely competitive world markets are where Alberta must swim or sink. Even those markets for our products within Canada generally have their prices set in the international arena. It doesn't take a long memory to recall the last time our oil and gas were shunned by the great population centers of eastern Canada, and faced a slow market in

the United States. Few of our other products would sell well in Canada if our prices were out of line with alternatives from other countries.

It is beginning to be apparent that developments that are very conservation conscious stand the best chance of surviving and thriving. This gives considerable cause for optimism for the blurring of the distinctions between development and conservation. It also provides some explanation for the apparent broadening of the common ground on which both thoughtful conservationists and successful business people stand.

The Objectives of an Alberta Conservation Strategy

The first three objectives are patterned after those of the World Conservation Strategy; the second three address the specific requirements of a Conservation Strategy for Alberta.

1. To maintain essential ecological processes and life support systems (such as soil regeneration and protection, recycling of nutrients, and the cleansing of waters), on which human survival and development depend;

2. To preserve genetic diversity (the range of genetic material found in the province's organisms), on which depend the functioning of many of the above processes and life-support systems, the research necessary for the protection and improvement of cultivated plants and domesticated animals, the micro-organisms so vital to our survival, and the security of the many industries that rely upon living resources;

3. To achieve sustainable use of species and ecosystems (notably fish and wildlife, forests, agricultural soils, and grazing

lands), which support some of our most important industries (tourism, forest products, farming);

4. To provide for the recreational, spiritual, aesthetic, and other non-material needs of Albertans by maintaining and developing diverse opportunities for the use of natural resources;

5. To maintain and improve the quality of life in the urban environment, where the majority of Albertans now live and work;

6. To use and manage our non-renewable resources in the interests of developing a long-term sustainable economy for Albertans.

Striving towards these goals is a matter of some considerable urgency in Alberta because:

1. Stopping and reversing the degradation of our agricultural soils due to losses of organic matter, salinity, acidification, wind erosion in the South and water erosion in the North is a matter of extreme importance to the economic future of this province. Water quality and water quantity have become such significant matters that they are limiting factors in the future economic and population growth in various parts of the province. The quality of air we breathe is a growing concern for many Albertans, especially in urban areas. These fundamental life support systems must be maintained and improved if we are to realize a level of economic activity that can support current and projected populations at an acceptable quality of living. As important as many of these issues are, priorizing and choosing those

offering the largest return on our investment in sustainable development is as important as recognizing the problems in the first place.

2. Preserving genetic diversity may seem to be an academic concern better suited to tropical rain forests where vast clearing is causing daily extinctions. However, this is not the case. Genetic diversity means for Alberta the preservation of our relatively small number of species and limited genetic diversity precisely because they are so limited. Our northern location and cold continental climate are the reasons Alberta does not have the range of species found in some other areas of the earth. Our native species of flora and fauna have survived in our part of the world because they have developed special adaptations. It is these distinct characteristics of Alberta's native and successful imported species that must be closely guarded. Genetic materials of even those plants or animals considered pests (such as well-adapted weeds) may contain factors necessary for developing superior characteristics in living resources useful to us all. The preferred method for preserving these materials may well be in seed banks, but it may be imprudent to completely wipe out some of our most persistent and costly weeds. The very characteristics that make them so annoying and costly may be those most useful to geneticists in the next few decades.

Likewise, much of our economy is based on a tiny number of living resources. Our agricultural landscape is essentially a patchwork quilt of artificially supported monocultures. Our livestock industry also consists of a very few varieties of cow, hog, chicken, and turkey. The forest products industry depends on a handful of tree species for survival, and a significant portion of our tourists are attracted by the excellent opportunities to see perhaps a dozen species of

large mammals, or catch an even smaller number of fish species. Our genetic base may be narrow, but its maintenance is vital to our future.

The rapid advances in biotechnology and the capacity of genetic engineering to change our world should give pause to us all. Whatever the ultimate effects, it appears that the preservation of our genetic base will become increasingly important in a world changing so rapidly. Now more than ever, we must be prepared to land on our feet when the unexpected happens again. This means keeping our options open, and our small but well adapted genetic base is one of our most important and underestimated assets.

3. To say that sustainable use of our species and ecological systems is essential is nearly tautological, that is, shown to be true within the very words used to say it. Defined broadly, resources include that most valuable of all resources, a well-educated human. Less than sustainable use of our resources by definition leads us to a life that might ultimately be as the philosopher Thomas Hobbes wrote in Leviathan, "solitary, poor, nasty, brutish, and short." However, long before such a state is reached, the non-sustainable use of resources begins to have a noticeable effect on the lives of people.

Planning for sustainable use of resources must take account of social and ecological factors as well as economic ones, of the interconnections among living and non-living resources, and of the long- and short-term advantages and disadvantages of alternative actions. It is these latter factors that determine the longer term economic value of our resources. At times it is acceptable, even prudent, to use resources at a rate above replenishment. But there is an inviolable law of nature at work where living resources are concerned. They

are renewable if conserved, and they are destructible if not. Once gone they will not return. As the saying goes " another heaven and another earth must pass before such a one can be again." We must exercise great care when overharvesting any living resource.

4. The World Conservation Strategy is primarily concerned with the material well-being of people and the complex of living resources upon which our existence depends. However, any consideration of conservation and development in the interests of the people of Alberta must include a major non-material component.

There are many reasons for concerning ourselves with the non-material benefits of our natural resources. They range from the cultural significance we give them to the moral and ethical questions of extinction. For purposes of the Alberta Conservation Strategy, these non-material benefits are grouped into five categories. They are outdoor recreation and leisure, cultural heritage, educational requirements, psychological needs, and matters of ethics, morality, and religion.

It would be difficult to overestimate the non-material value of the province's natural resources to Albertans. Urban amenities such as universities, libraries, beautiful buildings, parks, and cultural and sporting events exist because our natural resources provide us with the time and the wherewithal to create and enjoy such cultural refinements. All of us spend some of our time outside interacting with our natural environment. Even those of us who never leave the city usually appreciate the greenery of summer or the brisk air on a sunny winter day. Few Albertans would claim they don't notice and value the returning birds

of spring. Most of us, however, obtain great value from our diverse natural resources in more direct and planned ways.

In keeping with the overall direction of the Conservation Strategy, the greatest feasible range of options for future demands should be retained. The renewable or non-consumable resources (mountain vistas, undisturbed wildlife, clear mountain streams, unbroken forest landscapes, waterfalls, city parks, and so on) may increase in value at higher than anticipated rates. The massive popularity of wildlife and nature programming on television may lead to unforeseen demands on the recreational resources. The youth of today (who have been raised largely in the cities but with excellent nature programs) will turn into the recreational consumers of tomorrow. Wilderness experience, or at least improved opportunities for personal observation, photography, and study of wildlife and vegetation, may reach new peaks of demand. The unpredictable baby boom generation may rediscover the simple pleasures of scenic beauty and the less strenuous exercise these settings can offer the middle-aged. After the more frenetic urban lifestyle wears thin, a return to leisurely hikes through the mountains may appeal to a body too slow for the squash court. Simply stated, this means keeping options open.

5. The moral and ethical questions of extinction caused by human activities are likely to increase in importance as our activities continue to impinge on the habitats of other living things. The controversy is complex, and this document cannot cover the full range of ideas. However, there are two distinct positions on the matter that should be mentioned. First, some believe that the well-being of other creatures on this planet should be subject to the well-being of humans, even if that means the eradication of certain species. This position may have as its basis species self-interest, or

religious beliefs. Others believe that humans would be arrogant and immoral in the extreme to cause deliberately the extinction of another species. The latter beliefs are sometimes based on religious grounds, and sometimes on a moral and ethical system stemming from personal beliefs.

Even on this kind of fundamental issue, which touches some of our most deeply held beliefs, there is a certain amount of common ground. Those advocating the primacy of our own species usually do not attribute omniscience (having infinite awareness, understanding, and insight) to any person, nor to the entire species, assuming we could pool our mental resources. Since causing the extinction of a species closes for all time some options for future development, and since our species cannot know what the adverse consequences to ourselves (as a species) might be, it would be imprudent to cause extinctions unless our very existence depended upon the elimination of that species.

It would seem both groups should be against the deliberate causing of extinctions under any but the most extreme circumstances, and the argument should only be joined at that point. In the meantime, both groups should be able to support the preservation of genetic diversity to the extent reasonably possible since it is in our self-interest to so, and it is morally acceptable.

6. The growth of material prosperity in the industrialized nations has depended largely on a once-only windfall of rich accessible fuels and metallic ores. The most accessible and concentrated deposits known of coal, oil, natural gas, and other valuable minerals have been used or are currently under planned or actual development. This reality has meaning in Alberta as it does nowhere else in Canada.

> The world is not likely to run out of energy or raw materials, but it is almost certain that future sources will be relatively more expensive, and relatively more environmentally problematic. We in Alberta may have an inside track to future prosperity if our non-renewable oil sands and coal deposits are able to compete economically. But we must never forget that our energy resources are non-renewable and as such they cannot sustain development in the long term. There must be an eventual transition to renewable or more abundant resources.
>
> In Alberta, this transition may be slow and relatively painless, or it may come as a continuing series of shocks as alternative fuels, conservation, and less costly developments elsewhere drive our energy producing sector out of business in this province. Regardless of the form this transition takes, it will come and we must prepare for it now. That is why we have the Heritage Savings Trust Fund. This is part of the investment Albertans have made towards an economy based on sustainable development. The Heritage Fund represents some of the capital that we hope to use to ease the transition from a non-renewable and unsustainable economy to one capable of maintaining the quality of life of Albertans for the long haul.

The World Conservation Strategy is not simply an academic idea for those who think rather than do. It can help Albertans to focus their attention on the real world problems of development and conservation. Because our economy is export-based and export-driven, decisions about which resources to develop and which to hold in reserve until they are more valuable must be left to international and national markets, industrial strategists, and government policy makers. What the Conservation Strategy can tell us is that for our own protection we must avoid decisions that reduce future options, integrate the expertise of many disciplines in planning our future, anticipate

problems rather than await their blows, encourage that which we can do best over the long term, and continue to guide the transition to a renewable resource sustainable economy. Most importantly, developing a Conservation Strategy for Alberta can help guide us with practical suggestions for removing barriers to sustainable development.

ALBERTA'S PERSPECTIVE

Biogeographical Features

The province of Alberta is located in a part of North America where many features come together to create an environment that is biologically and geographically diverse. Covering an area of 660,932 square kilometres (255,285 square miles), Alberta has within its boundaries an exciting array of open spaces, spectacular geological formations, wild rivers, and a variety of natural communities.

It is the legacy of millions of years of geological activity that has provided Alberta with its large energy resource base. The gradual drifting of continents over the globe caused repeated oceanic intrusions, which allowed the formation of oil, gas, coal, and oil sands deposits. The last glaciation, ending about 12,000 years ago, put the finishing touches on our landscape, gouging out rivers and lakes and depositing the parent material from which today's soils were formed.

In general, the province's climate is a continental one, largely influenced by latitude, altitude, and the direction of the prevailing winds. Lying between the 49th and 60th parallels of north latitude, most of Alberta is in the cool temperate climatic zone, experiencing generally cold winters and short cool summers. However, temperature and moisture conditions can vary significantly from south to north and from year to year. Snow falls over the whole province in most winters, but the bulk of the precipitation occurs in summer; even so, in a dry year this may still be insufficient for crop growth in many areas.

Alberta's physical landscape was more or less determined when the glaciers retreated, and is readily divisible into four main physiographic areas: the Canadian Shield in the northeast corner, the long folded ridges of the Foothills belt in western Alberta, the Rocky Mountains, and the extensive Plains region which covers about 75

percent of the province. Figure 1 shows the four physiographic areas of Alberta while the major vegetation zones are shown in Figure 2.

The Canadian Shield is characterized by many small lakes and marshy depressions, a disorganized drainage system, and numerous hard rock outcrops dating from Pre-Cambrian times. Compared with the rest of the province, this area lacks biological diversity. Climatic and soil conditions combine to limit vegetation growth, although muskeg is extensive.

Alberta's Foothills are a belt of rugged ridges that provide a spectacular transition zone between the plains to the east and the mountains. Running more or less parallel to the Rockies, the foothills are lower in altitude and are characterized by steep-sided valleys between the forested ridges. Coniferous trees dominate the forests, although hardy poplars are common at lower altitudes, and the wildlife is abundant and varied. Valleys in the foothills contain many meandering streams that originate in the adjacent mountains and form the headwaters for Alberta's major river systems.

The Rocky Mountains form the southwest boundary of the province, reaching heights of 3,600 metres (12,000 feet). They were formed from once-continuous beds of hard limestone that have been broken by faulting and then folded. Altitude is the major factor controlling the distribution of vegetation and wildlife. Coniferous forests again dominate, but habitats within the mountains are varied, and both plant and animal inhabitants show subtle adaptations to local conditions.

The Plains of Alberta dominate the province's terrain, although the only feature common to the 495,900 square kilometres (191,500 square miles) they cover is that they are underlain by softer, younger rocks than those of the Canadian Shield. The plains include high hill regions, rolling uplands, both undulating and flat lowlands, and marshy, swamp-covered regions with shallow lakes.

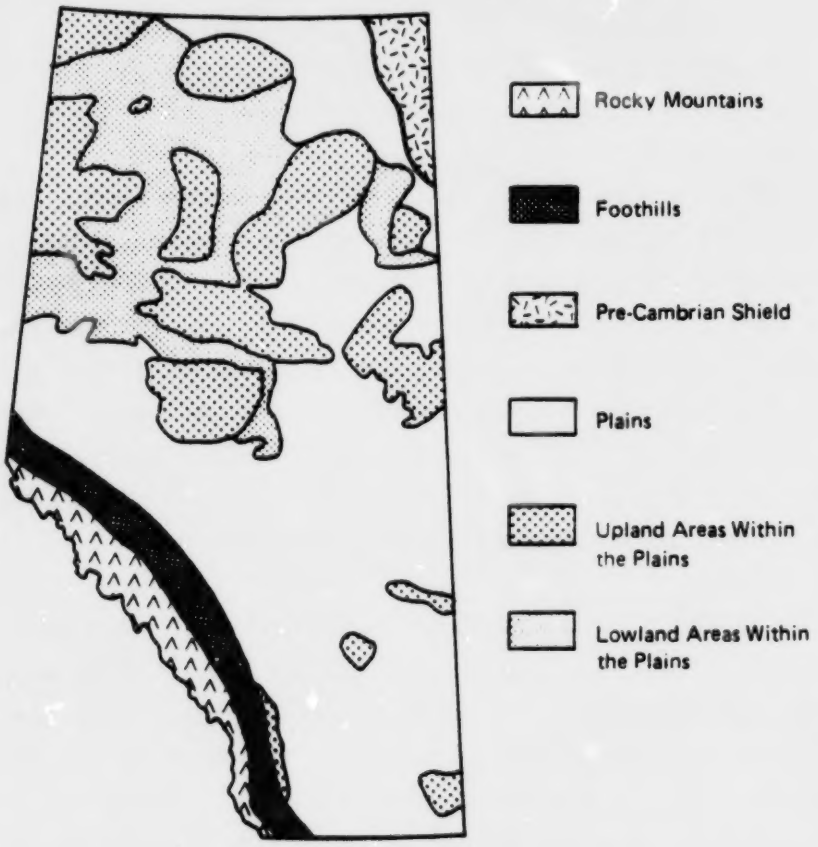


FIGURE 1

Alberta's Physical Landscape

Source : Adapted from Atlas of Alberta 1969

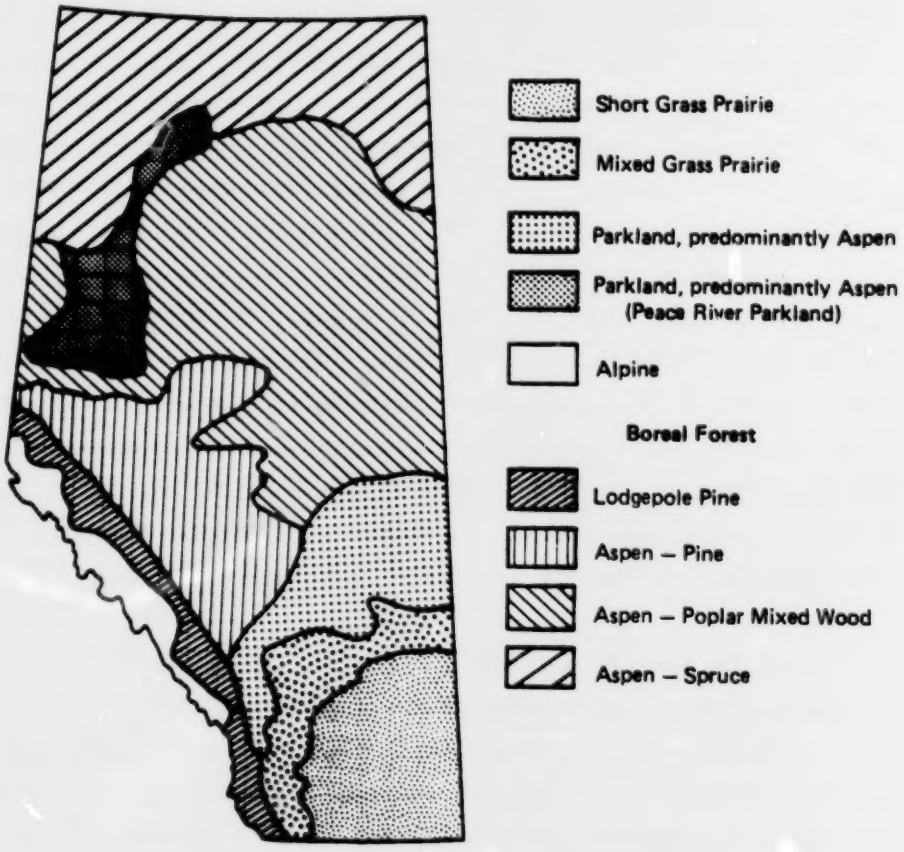


FIGURE 2

Vegetation of Alberta

Source : Adapted from Hardy 1969 and Strong and Leggat 1981

Within the plains, vegetation formations are defined largely by latitude. The prairies in the south are separated from the boreal forest in the north by a belt of aspen parkland and aspen forest that extends across much of central Alberta east of the foothills. The prairies and parkland, moreso than the boreal forest, have been affected by human activities, with the result that much of the native prairie grassland has been replaced by farmland, and portions of the aspen parkland have been cleared and drained, also for agricultural pursuits. Nevertheless, both of these vegetation zones support a variety of plant and animal species, many of which have adapted to co-exist with humans. The boreal forest is the largest vegetation zone in Alberta, covering roughly 397,000 square kilometres (153,000 square miles), including the foothills. There is a great deal of variation in plant communities contained within this broader classification because the soils and topography are variable. But the feature common to all plants found here is an adaptation to extremely cold winters and a short growing season. Conifers dominate, although mixtures of aspen and white spruce are common. Animals that live in the boreal forest year round also have special adaptations for winter survival, including both physical and dietary changes for coping with cold.

Wildlife species include small and large mammals, birds, fishes, and many forms of invertebrates. Among the ungulates are moose, elk, deer, antelope, caribou, and alpine species of sheep and goats. Bears, coyotes, wild cats, wolves, and various rodents, as well as a variety of songbirds, raptors, waterfowl, and game birds are all part of the wildlife of Alberta.

Alberta's Human Resources

The role of people in the processes of conservation and development is crucial. Where people settle; what they require in the way of food, shelter, and clothing; and the activities they pursue as recreation or occupation all affect the use of our natural resources. In a discussion of natural resource use, both population numbers and

population distribution are important. Also, other demographic characteristics such as age, education, and mobility influence consumer demand for resources and services as well as for manufactured goods.

Early Settlers

Although it is likely that there were human occupants of Alberta as long ago as 30,000 years, no evidence of their presence has ever been found. The first human residents for which there is archaeological evidence probably arrived in Alberta some 11,000 years ago, shortly after the last ice sheets disappeared. There are gaps in our knowledge of these ancient people, but evidence indicates that movement into Alberta at this time was generally from south to north as the hunters from the American Great Plains followed the retreating ice sheets. The record is more detailed for the period since about 600 A.D. and many artifacts have been found to suggest that native people were quite proficient hunters.

In the period just prior to the arrival of fur traders and Europeans, the indigenous peoples are thought to have enjoyed a relatively comfortable lifestyle. The widespread use of buffalo jumps had made their food supply certain, thereby supporting an increased population size and allowing them leisure time to develop more elaborate social and ceremonial activities. The Indians of this time were divided into southern groups who roamed the plains and the more northerly groups who actively fished and trapped.

In 1690, the first major inland expedition to western Canada (known then as Rupert's Land) was sponsored by the Hudson's Bay Company. Henry Kelsey, accompanied by a group of Indians, went as far as central Saskatchewan. In the century that followed, the major reason for further exploration was establishment of the fur trade. Anthony Henday was the first European to set foot in what is now Alberta, on an expedition also sponsored by the Hudson's Bay Company. Although the rival North West Company sent its own explorer, Peter

Pond, into northern Alberta in 1778, David Thompson and Alexander Mackenzie are perhaps the best known of the early explorers. Each made several lengthy journeys in the late 1700s and early 1800s into western and northern Alberta, with Thompson in particular leaving a legacy of maps and descriptions of the landscape.

Competition between the North West Company and the Hudson's Bay Company raged for decades, resulting in a plethora of trading posts, as each tried to obtain the advantage. The effects on the culture and physical well-being of native societies were evident as alcohol abuse and disease became more common. The intense rivalry also was seriously depleting the fur-bearing resource and this, combined with the heavy costs of running two essentially parallel operations, brought both companies to the verge of bankruptcy by 1821. At this point, a merger was agreed to, and the Hudson's Bay Company name remained. As a monopoly, the Company could manage the fur-bearing populations and make an effort to improve conditions for the trappers. The fur trade in Alberta reached its peak in the first half of the 19th century; by the end of this period, small settlements were evident around the trading posts and the newly formed Christian missions.

In eastern Canada, Europe, and the United States, there was increasing interest in the Canadian west, and expeditions of a more scientific nature were undertaken in the early decades of the 19th century. Richardson, Drummond, Douglas, Palliser, Hector, Bourgeau, and Blakiston reported on various aspects of Alberta's landscape, flora, and fauna; these early visitors live on, since their names have been given to lakes, mountains, and species of plants and animals which are found in Alberta.

Following Confederation, Rupert's Land was purchased by the new Dominion of Canada from the Hudson's Bay Company. Various agencies of the Canadian Government began carrying out official scientific investigations of the vast land; of these, one which was to have a profound effect on future settlement patterns was the Land Survey, which divided the territory into townships and sections.

In the last quarter of the 19th century, major changes occurred. The North-West Mounted Police were sent to Alberta to quell the illegal trafficking in whiskey; treaties were signed between many of the Indian tribes and the Canadian Government; the bison that had been the mainstay of native existence disappeared from the Canadian prairies; and the transcontinental railroad was completed.

Settlement Patterns

Up to this time, most of the settlement in Alberta reflected the reliance by the early fur traders upon rivers as transportation routes, with the majority of settlements found in the central and northern parts of the province. However, completion of the railroad combined with the development of the early-ripening Marquis wheat and an aggressive selling of the west in eastern Canada, the United States, and Europe, resulted in a massive influx of settlers who came mainly to southern Alberta. Between 1901 and 1911 the population increased from 73,022 to 374,663. Ten years later, in 1921, some 29 million acres (12 million hectares) of land had been claimed by 83,000 farmers, and in the south, 217,000 acres (87,000 hectares) were already being irrigated. Edmonton, Calgary, Lethbridge, and Medicine Hat were the main centers, providing supplies and services for the burgeoning agriculture industry.

Rapid settlement created a demand for houses, which had to be heated. Consequently, numerous sawmills sprang up in the foothills and northern forests, and coal mining became a major industry in southwestern Alberta. Natural gas had been discovered near Medicine Hat in 1885, and just before World War I another discovery was made near Bow Island. The first major oil find in Alberta was the Turner Valley field in 1914, but it wasn't until the discovery of Leduc Number One in 1947 that Alberta's prospects for prosperity and a more diversified economy began to improve.

The early period between these two historic oil finds saw the agriculture, forest, coal, and natural gas industries increase in size and efficiency, but the Depression of the 1930s was as devastating to Alberta as it was to the rest of the Prairies. The resource-based economy virtually came to a standstill as parched soils blew away and forest fires burned out of control. The importance of the events of this period was impressed on many who tried to analyze what went wrong. Better conservation practices, particularly in agriculture, were encouraged and government agencies were set up to assist farmers with their implementation.

Following the end of World War II and the Leduc discovery, other oilfields were soon found and brought into production, while at the same time, natural gas was recognized as an important source of energy and export earnings. Alberta's population grew rapidly during this time, and agriculture was no longer the dominant industry in the province.

Since the 1930s and 1940s, population distribution has shifted markedly in Alberta, and much of this is related to our resource-based industries. In 1931, approximately 65 percent of the population was classed as rural and most of these people lived on farms. But agriculture subsequently underwent a technical revolution that meant labor inputs could be reduced while maintaining or increasing productivity; many of these advancements occurred at the same time petroleum resources were being discovered and the labor force was needed in areas other than agriculture. Food-processing industries also sprang up and, as a result, the population became significantly more urbanized; by 1981, the actual farm population had dropped to 190,000 from 340,000 in 1951 (that is, from 36 percent of the total population to 8.5 percent). Although there has been a trend to country residences in Alberta in the last decade, and thus an increase in the number of rural non-farm residents, their overall significance is relatively modest. Of more importance is the concentration of people in major urban centers and the increase in the number of urban centers. "A population of 1,000 is often used as a crude breakpoint between

urban and rural; by this criterion there were only 38 urban places in Alberta in 1946, as compared with 114 thirty-five years later" (Smith 1984: 22). The development of population centers and transportation routes in Alberta is shown in Figure 3.

Expansion of agricultural and resource frontiers has had a major impact on the rise and fall of Alberta's smaller urban centers. Smith (1984) has pointed out that the towns and villages in Alberta's "frontier" areas (such as the Peace River area and near the Eastern Slopes) have tended to grow while those suffering declines have generally been in the long-developed agricultural zone where the effects of centralization were greatest. This centralization, or the tendency of people to concentrate in a few large centers, is associated with the development and maturity of a more complex, sophisticated economic structure. A variety of goods and services can be provided in these places at competitive prices; increased consumer mobility and affluence means that proximity to such a center can contribute to the decline of rural towns and villages.

Demographic Characteristics

According to the 1981 census (Statistics Canada 1985), Alberta's population was slightly more than 2.2 million, putting our province fourth in the country, with 9.2 percent of the total Canadian population. Since the pioneer days, Alberta's population has been a mix of ethnic groups. Although citizens of British descent still constitute the largest group (about 43 percent of the total), German, Ukrainian, French, and people of other single origin comprise an additional 44 percent of the population. Only 3.3 percent of Alberta's population (72,055 individuals) declared native ancestry in the 1981 census, including status Indians, Metis, and Inuit. More than two-thirds of these people lived in northern Alberta.

The age structure of Alberta's population deviates from the usual in that, as elsewhere in North America, there is a bulge in the present

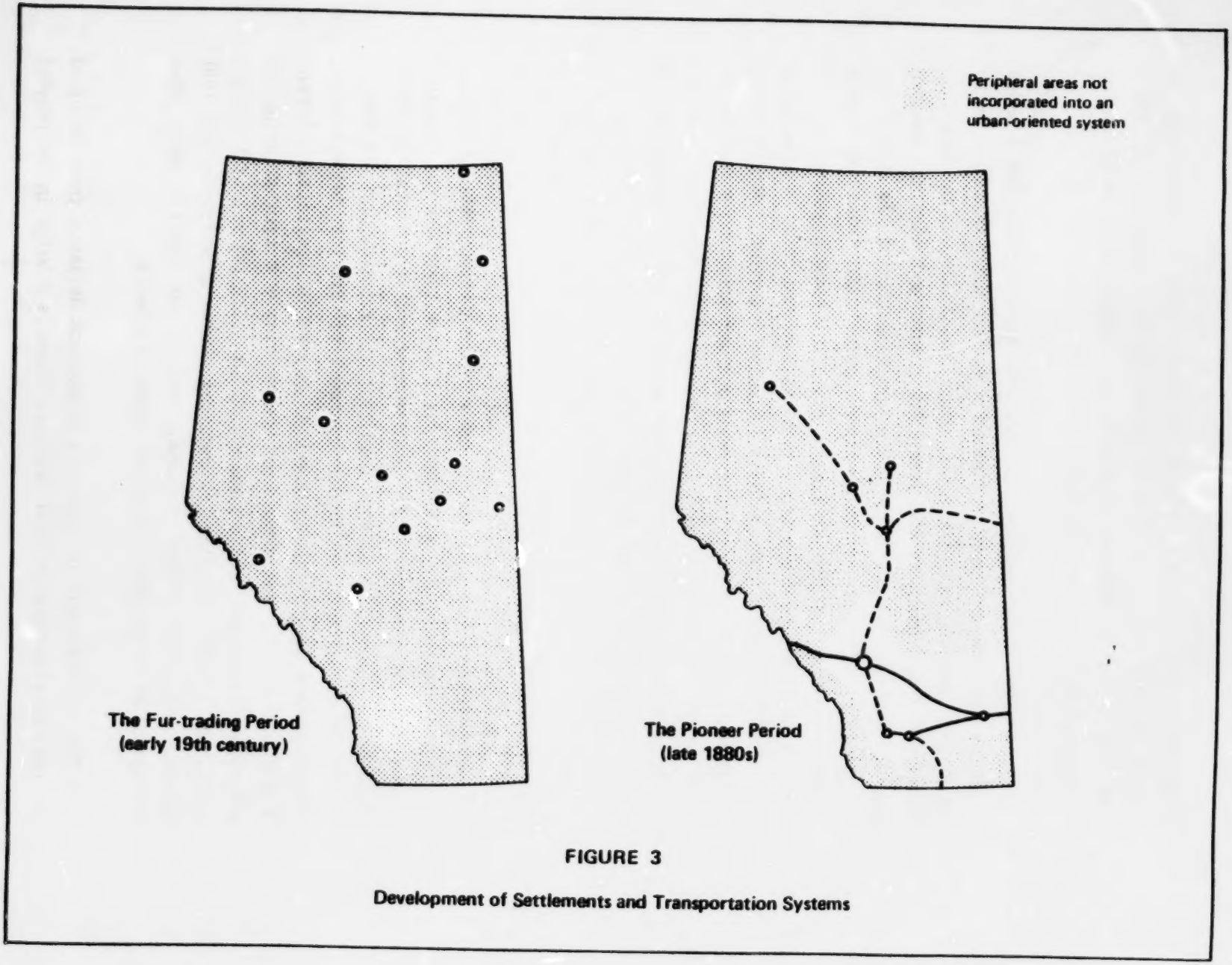

Peripheral areas not incorporated into an urban-oriented system
The Fur-trading Period (early 19th century)
The Pioneer Period (late 1880s)

FIGURE 3

Development of Settlements and Transportation Systems

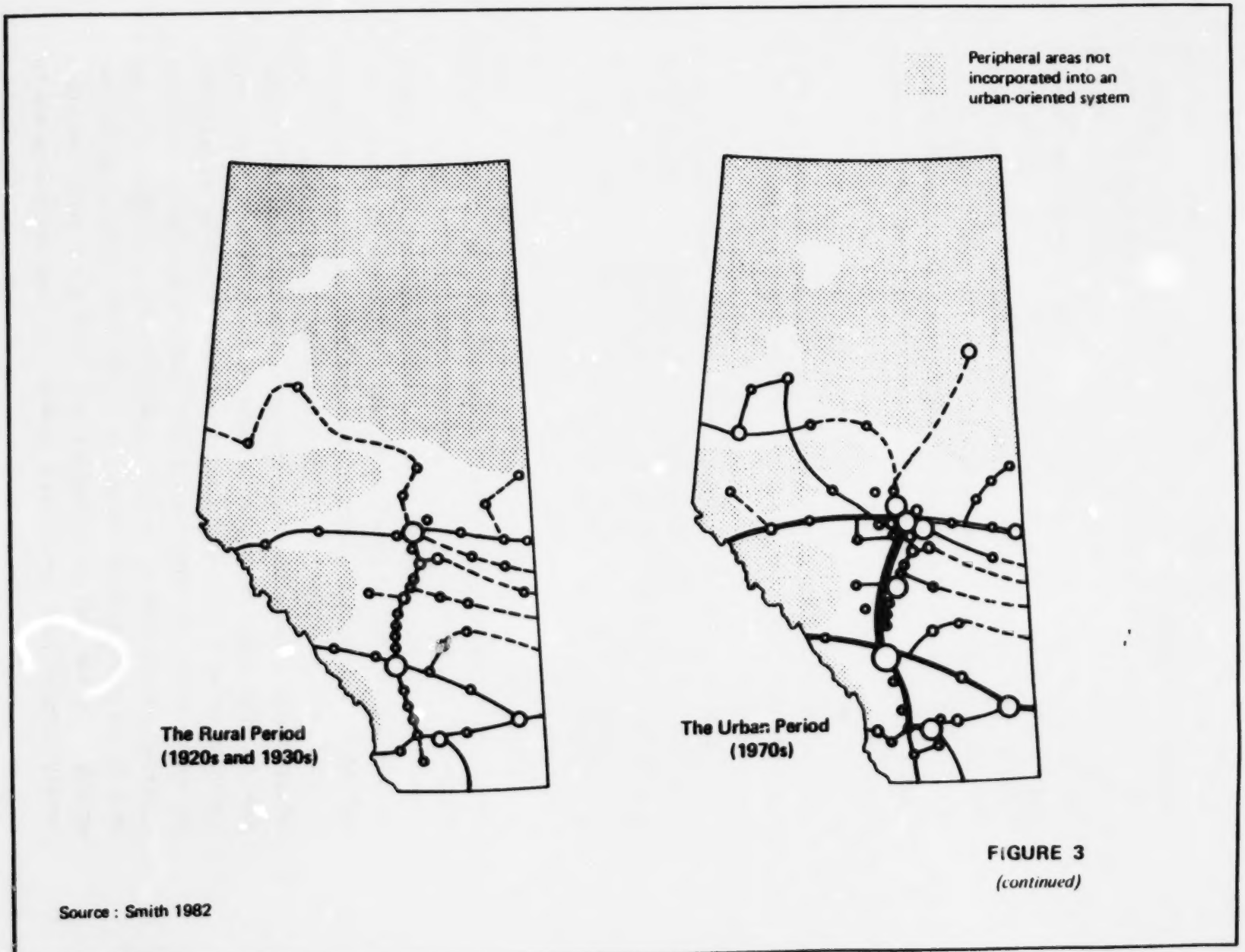

Peripheral areas not incorporated into an urban-oriented system
The Rural Period (1920s and 1930s)
The Urban Period (1970s)

FIGURE 3
(continued)

Source : Smith 1982

20-30 year category due to the post-war "baby boom". As this generation produces families of its own, the population can be expected to continue growing, along with demand for goods and services. There will, nevertheless, be a gradual aging of the population; in 1981 the median age was 26.9 years and by 1983 this had already risen to 27.8 (Statistics Canada 1985); this is likely to reach 31 by 1991 and 33-35 by the year 2000 (Kosinski 1984). In addition to being young, Alberta's population is well-educated; the 1981 census revealed that 9.6 percent of Albertans had university degrees, the highest proportion in the country, while more than 40 percent had some post-secondary education.

In the early 1900s, most Alberta residents were not born here. As our population grew, the proportion of Alberta-born residents increased from 20 percent in 1911 to 62 percent in 1971 (Kosinski 1984). The huge influx of migrants to Alberta in the 1970s caused this figure to drop, but over the long term this figure has been indicative of an increasing stability of population.

Conclusion

Alberta's human history and economic development have been inextricably linked to our natural resources. Movement of bison herds influenced the lifestyle of the earliest residents; the presence of fur-bearing animals sustained northern natives and provided the impetus for exploration and original settlement of Alberta by non-natives; fertile soils brought thousands of pioneers into the province in search of land and livelihood. In recent decades, development of our petroleum sector has allowed our economy to diversify, and has provided jobs for thousands of people in energy-related areas. Agriculture continues to be a major contributor to Alberta's economy as well, but our resources of petroleum and forest products and the recreational opportunities afforded by the breathtaking beauty and diversity of our natural environment have become very important components of our economy. In the past, the quality and location of these resources largely dictated human activities; however, if these activities are to

be sustained and continued, new strategies will be needed to ensure that our resources and life-support systems are not irreparably damaged.

The human relationship with our natural environment has not always been a peaceful one, but we do have the capacity to learn from our mistakes. Human resources are generally not thought of as a "renewable resource", but these are perhaps the most important renewable resource of all. Alberta's history and world history have shown the impact humans can have on their surroundings and their resources. These impacts have been both positive and negative, and in some cases we have been able to partially mitigate the negative effects. For example, although it was human activities that caused the disappearance of the buffalo, we have managed to preserve some of these animals in parks and reserves. Although improper agricultural practices were at least partly responsible for the soil erosion problems of the Dirty Thirties, we now have methods for controlling and preventing such occurrences. However, this is one area where serious problems still exist on many farms in Alberta and something must be done to ensure that our soils remain fertile and productive.

Land and Resource Use

Although most of the better land in Alberta gradually went into private ownership as the province was settled, the Government of Canada retained ownership of the remainder. Since 1930, when ownership and management responsibilities were transferred to the Government of Alberta, the proportion of public to private land has not changed much. Today, approximately 28 percent of the land in Alberta is privately owned, with the Province owning and managing, on behalf of the people of Alberta, about 62 percent and the federal government involved in the remaining 10 percent (mainly Indian reserves and national parks).

In 1948, Order in Council 113-48 delineated the Green Area, withdrawing this land from settlement. This was mainly the forested

area and was considered unsuitable for agriculture. Subsequently, the land which was settled initially and which was mainly in private ownership was designated as the White Area, while the remaining portion in the Peace River region came to be known as the Yellow Area (see Figure 4). Land in the Yellow Area was in the process of changing from public ownership to private ownership. Although there have been changes to the boundaries of the Green Area, most of the land in this category has remained in public ownership to facilitate multiple use and management. Large areas of public land also are found in the White Area, and much of this is under grazing lease.

To some extent, resource uses and development correspond to land tenure. For example, intensive agricultural activities are concentrated in the White Area, although grazing is permitted in portions of the Green Area. Forestry, on the other hand, is confined to lands in the Green Area, while trapping and resource extraction take place in both. The major boundary between the settled area and the area withdrawn from settlement also corresponds roughly to the vegetation zones discussed earlier; that is, the prairies and parkland are generally included in the White Area while the Green Area is primarily boreal forest.

Agriculture

Agriculture is the second largest land user in Alberta after forestry, with 49.9 million acres of occupied farmland identified in the 1981 census. The amount of land in agriculture increased steadily following settlement, with 6.2 million acres being added to this land base between 1941 and 1971 (ECA 1985: 140). But 1981 figures suggest that this expansion may have come to a halt; fewer than 0.5 million acres were added to the agricultural land base between 1971 and 1981 (ECA 1985: 140). It also appears that the total number of farms is continuing to decline, as about 58,000 farms were identified in the 1981 census, down from 62,700 in 1971 and 73,200 in 1961. This is reflected in the decline of the rural farm population. Nevertheless,

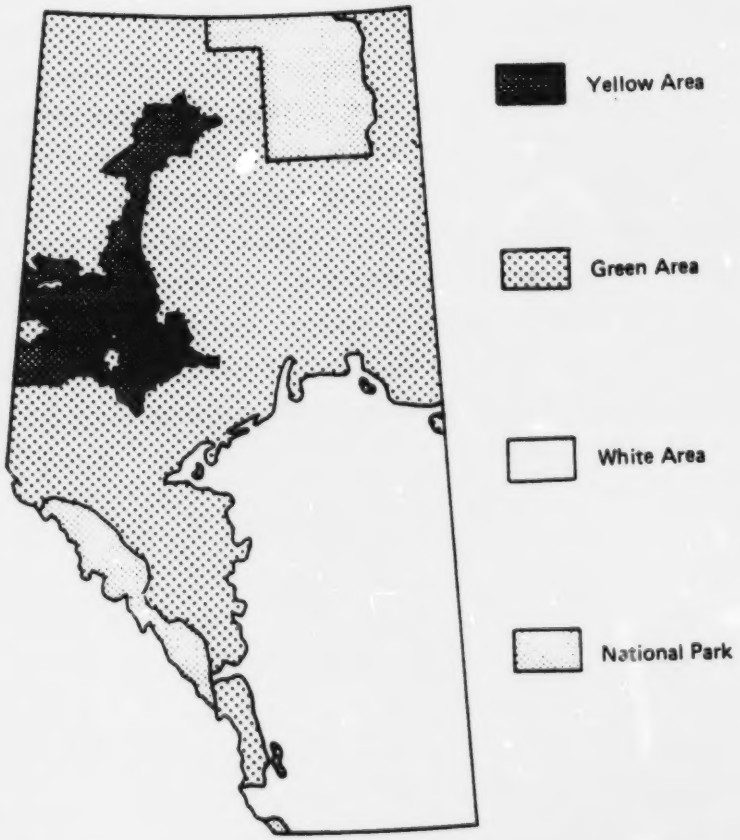


FIGURE 4

Land Use Zones in Alberta

Source : Government of Alberta

agricultural production has been maintained or increased despite the decline in the number of farmers, suggesting that the industry has improved its efficiency considerably.

Although the number of people involved in the primary production end of agriculture has declined, agriculture still has a major impact on Alberta's economy through the development of secondary and related industries. Total farm cash receipts in 1983 amounted to $3.7 billion (Alberta Agriculture 1985), with beef, oilseeds (mainly canola), and grains as the mainstays of Alberta agriculture. Agriculture supply and service industries provide jobs for thousands of people, as Alberta farmers spend more than $1 billion annually on chemicals, fuel, processed feed, equipment, repairs, veterinary and accounting services, and other necessary items (Ironside 1984). Furthermore, the food and beverage industry employs some 16,000 people, which represents about 20 percent of the jobs in manufacturing, making agriculture a major force in the province's economy.

Forestry

Alberta's forests cover about 60 percent of the province, some 397,000 square kilometres (that is, 155,068 square miles, or about 99.2 million acres), which, for management purposes, are divided into ten major forests. Of this, about 164,000 square kilometres (41 million acres) are considered productive forest, supporting some 1.5 billion cubic metres of wood; an additional 71,905 square kilometres (17.9 million acres) have the potential to produce forest products (Alberta Energy and Natural Resources 1984). Annual harvest is of course only a fraction of the total volume and, in 1983/84, the total amount of wood harvested from public lands reached a record 7.3 million cubic metres (about 3.1 billion board feet), 92 percent of which was coniferous yield (Alberta Energy and Natural Resources 1984).

The forest industry is also an important contributor to Alberta's economy. The total value of the 1983/84 wood harvest was in excess of

$353 million (Alberta Energy and Natural Resources 1984). Related manufacturing industries increased the value of the timber resource, and in 1984 the estimated value of goods manufactured in Alberta by wood industries and paper and allied products industries exceeded $786 million (Alberta Treasury 1985a). The forest industry employs some 10 percent of Alberta's population directly and indirectly; this employment can have implications for other industries as well, since many farm workers, particularly in the frontier areas, rely on off-farm income supplied by the forest industry to help maintain their farms.

Our forests are very important in other ways that are difficult to measure in economic terms. The role of forests in watershed protection and maintenance and as habitat for wild animals, including fur-bearers, is crucial. Forested areas are also favorite recreation spots for many Albertans who visit them to hike, hunt, fish, watch birds, and picnic. This aspect of our forested land is often taken for granted and frequently under-valued or not assigned an explicit value at all in discussions about resource use and management. However, these other benefits of the forest resource are important and have widespread implications; therefore they, as well as the actual value of the wood fiber, must be considered when decisions about resource use and management are being made.

Fish and Wildlife

As it was hundreds of years ago, the wildlife resource is important to native people in Alberta. Subsistence hunting is practised mainly in the Green Area by treaty Indians and some Metis, with big game species being the most desired animals. The market value of the meat harvested by Treaty Indians and other subsistence users is estimated at $8 million annually (Fish and Wildlife Division 1984).

Our fish and wildlife resources are important to many Albertans in a recreational sense, and the money anglers and hunters spend on licences, equipment, lodging, food, and transportation is not

insignificant. Estimates of the money spent by hunters and anglers to enjoy their sports are difficult to produce. However, it was estimated that anglers would spend in excess of $4.3 million in pursuit of recreational angling in 1980, while hunters were expected to spend about $77 million to pursue their sport (Glasgow 1982). In addition, direct government revenues from fish and wildlife, in the form of licences and resource development stamps, amounted to $6.9 million in fiscal year 1983/84 (Alberta Energy and Natural Resources 1984).

The amount of money spent by Alberta residents, out-of-province residents, and foreign visitors on trips taken primarily to view, fish, or hunt the fish and wildlife resource in Alberta is in excess of $800 million per year (Fish and Wildlife Division 1984). Furthermore, the secondary benefits of these expenditures generated more than one billion dollars of economic activity and created more than 33,000 person-years of employment (Fish and Wildlife Division 1984; Alberta Treasury 1984. See also Adamowicz and Phillips 1983.). About 70 percent of these jobs were in the retail sector through purchases of equipment used mainly for viewing, fishing, or hunting; 20 percent were in transportation, and the remaining 10 percent were in the provision of accommodation and food services (Fish and Wildlife Division 1984).

Fur-bearing animals are also an important wildlife resource, providing significant income to the approximately 8,000 trappers in Alberta. The total value of pelts harvested has declined though, from $15.5 million in the 1979/80 season to $5.7 million in 1983/84 (based on records of furs exported from Alberta). The number of pelts harvested in the 1983/84 season was less than a third of that taken in 1979/80, dropping from 1,830,551 to 507,376. Figures for 1983/84 indicate that there were 4,987 resident trappers (that is, those on private land) and 2,973 registered trappers (those on public land) in Alberta (Alberta Energy and Natural Resources 1984).

Tourism and Recreation

During the 1970s travel was the world's fastest growing industry; improved transportation, more flexible work schedules, and personal desire to visit other countries are likely to make this a growth industry for some time. For Canada as a whole, the tourism industry is the largest single employer; approximately 900,000 Canadians or about 8.5 percent of the labor force work in tourism-related jobs (Voyer and Murphy 1984).

In Alberta, total 1984 tourism receipts amounted to some $2.0 billion, making tourism the fourth-ranked industry in bringing dollars into the province (Government of Alberta 1985). Further, the tourism industry is one of Alberta's largest employers, directly and indirectly providing more than 100,000 positions, of which about 73,000 are full-time (Government of Alberta 1985). Although out-of-province visitors contributed an estimated $1.1 billion to Alberta's economy in 1984, the $0.9 billion spent by Alberta residents suggests that we travel around our province too. This does not include the money spent on equipment purchased for activities such as hunting, fishing, skiing, or camping, which is also substantial.

Environmental features have traditionally been a key component in Alberta's tourism industry. In particular, our mountains, wilderness, and uncrowded countryside attract not only foreign and out-of-province visitors, but Alberta residents as well. Indeed, "Canada's natural attractions, exemplified by our system of national, provincial, and municipal parks, can compete with the world's best" (Tourism Canada 1984: 45). Without these natural assets and the foresight of those who wished to preserve them, our enviable system of parks and the associated tourist spin-offs would simply not exist.

The Energy Sector

The energy sector in all its forms has been the powerhouse of the Alberta economy for the past decade. The oil and gas industry, including heavy oil and oil sands, out-paced most other sectors of our economy during the hectic '70s and the very much slower '80s. The value of fuel production (coal, natural gas, gas byproducts, and oil) increased from $1.575 billion in 1971 to about $25.1 billion in 1984 (Alberta Treasury 1982; Alberta Treasury 1985b).

Production of petroleum crude during 1984 was 75 million cubic metres, the highest total since 1980. Natural gas production reached the highest level since 1981. Coal production in 1984 had increased about 260 percent since 1971. In 1983, the latest year for which figures are available, the mining sector (97 percent of which was oil, gas, and coal) and the utilities sector contributed over 27 percent of the Gross Domestic Product (Alberta Treasury 1985b). This does not include any financial, service, trade, construction, or other business resulting from energy-sector activities.

The province of Alberta produces roughly 85 percent of all the crude oil produced in the nation. But only a fraction of the oil in the fields of Alberta can be recovered. Despite the increasing use of various technologies to improve the percentage of recoverable oil, only 28 percent of the total known amount can actually be brought to the surface. This fact, combined with the annual rates of production and the slower rate of discovery of new oil, has resulted in the reduction of reserves of crude oil in every year except one since 1969. Since the late 1970s, the ability to continue relatively constant total production of crude oil has been the result of the increasing production of synthetic crude from the vast deposits of oil sands in northeastern Alberta. Projections are that a much higher dependence on these and other sources of synthetic crude will be necessary for oil production to remain at present levels. Potentially recoverable reserves of crude oil from oil sands are truly enormous, rivaling the quantities known to exist in the Middle East. However, the cost of

recovering and processing this synthetic oil is much higher than for conventional crude either here or in the Middle East.

The supply of natural gas, on the other hand, is projected to remain above production rates until the early 1990s. Much of the natural gas found in Alberta has a considerable component of sulphur in it when extracted. The sulphur content varies from zero to over 60 percent. Gas having more than a few percent sulphur is called "sour" gas. In the last several years, world markets for elemental sulphur have increased substantially, making the sulphur recovered from sour gas a valuable addition to the overall economics of gas production and sales.

Coal production continues to rise slightly each year, but world demand for the product has been uncertain. Alberta exported about 21 percent of its coal production in 1984, most of it to Japan and Korea (ERCB 1985). The remaining 79 percent was used primarily for electrical generation in Alberta. There is a geographical division in coal production and use, with most of the coal produced in the mountain and foothill areas being exported and the coal produced on the plains of Alberta being used for domestic electricity generation.

Only about 5 percent of Alberta's electric energy production comes from hydro plants. There are 11 hydro plants on the Bow River system and two on the North Saskatchewan system. Although plans for two large hydro plants have been made, current projections for Alberta electricity demands have resulted in the delay of both these projects. The river systems involved are the Peace River near Dunvegan, and the Slave River near Mountain Rapids.

The energy sector has been and probably will continue to be one of the most important contributors to the Alberta economy for the foreseeable future. Energy industry employment was estimated at over 75,000 in 1984. The future role of the energy sector in our economy is complicated by the fact that, as with so many of the significant

economic features of the Alberta scene, this sector is highly reliant on international markets for its prices.

Conclusion

Alberta's resource industries are big business, which means that conserving and protecting the productivity of the resource base should be big business too. In many cases, we have the knowledge required to manage our resources on a sustainable, renewable basis; what is lacking is the incentive to forego more certain short-term benefits that might reduce the long-term productivity of the resource. Our non-renewable resources can also be managed to support the long-term goal of sustainability. We have come a long way down this path. Now we need to identify explicitly that a sustainable economy is our goal.

The concept of development and conservation going hand in hand is not a new one to many Albertans. Those engaged in planning and using our resources know that these two aspects must be considered together if any resource-based industry is to be viable in the long term.

Later sections of this document discuss the condition of our renewable resources and life-support systems, the problems facing the people who manage these resources, and how a Conservation Strategy for Alberta could provide a framework and direction to ensure their long-term health and viability.

OBJECTIVES FOR AN ALBERTA CONSERVATION STRATEGY

The conservation of resources is a necessary but not a sufficient condition to ensure sustainable development and the well-being of our species. However, "the integration of conservation and development is particularly important, because unless patterns of development that also conserve living resources are widely adopted, it will become impossible to meet the needs of today without foreclosing the achievement of tomorrow's" (IUCN 1980: 1.8). The World Conservation Strategy identifies three objectives of conservation for sustainable development:

(1) to maintain essential ecological processes and life-support systems;
(2) to preserve genetic diversity;
(3) to achieve sustainable use of species and ecosystems.

Applicable to countries and ecosystems around the world, these objectives are flexible enough to accommodate local conditions yet are so basic that, if they are met, sustainable development and maintenance of our quality of life will be virtually assured.

Three more objectives are added to a conservation strategy for Alberta:

(4) to provide for the recreational, spiritual, aesthetic, and other non-material needs of Albertans by maintaining and developing diverse opportunities for the use of natural resources;
(5) to maintain and improve the quality of life in the urban environment, where the majority of Albertans now live and work;
(6) to use and manage our non-renewable resources in the interests of developing a long-term sustainable economy for Albertans.

Objective 1. To maintain essential ecological processes and life-support systems

> "Essential ecological processes are those processes that are governed, supported, or strongly moderated by ecosystems and are essential for food production, health, and other aspects of human survival and sustainable development. 'Life-support systems' is shorthand for the main ecosystems involved" (IUCN 1980: 2.1).

Soil, water, and air are all critical components of the essential ecological processes and our life-support systems.

Soil

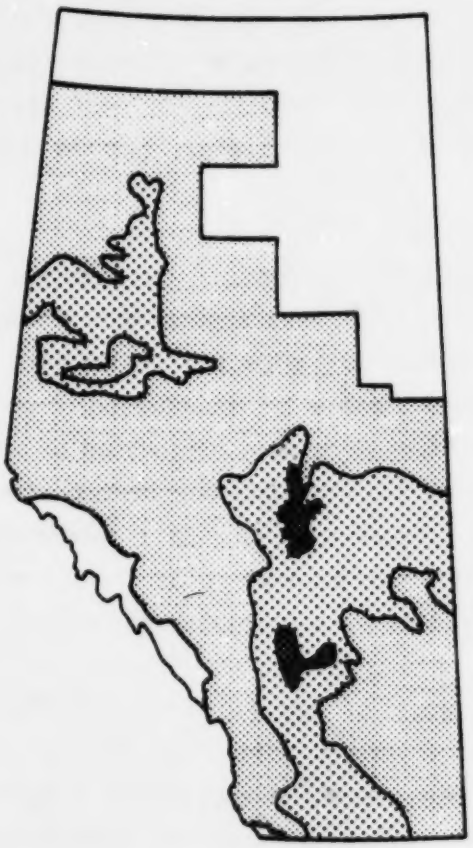
Soil is such an essential part of our life-support system that most of us take for granted the living earth beneath our feet. Although plants are the primary producers, transforming energy from the sun into a form consumers (including humans) can use, plants do not grow well without healthy soil, and all other organisms in the food chain are then affected.

To the uninitiated, soil appears to be simply a dark mass of amorphous material, the color and texture of which may vary. Closer inspection reveals that a mere teaspoon of good-quality soil contains millions of micro-organisms; an acre of such soil is home to billions of microbes and hundreds of millions of invertebrates including mites, insects, millipedes, and worms. Many of the creatures that inhabit the thin layer of soil covering Earth's land surface are decomposers, without which we would soon be buried in plant and animal remains. These decomposers, mainly fungi and bacteria, are constantly breaking down biological material and releasing the nutrients this material contains, so that they are again available to living organisms. Activity on a forest floor is a good example of this process; autumn leaves are quickly broken down and their nutrients returned to the soil to be used again by growing trees and other plants.

This process of breakdown and renewal goes on to some degree in all soils, but healthy soil contains an abundance of decomposer micro-organisms which themselves provide food for other soil animals. Furthermore, this process feeds on itself, so that as more organic material is available, the number of micro-organisms increases. Not only are more nutrients recycled in this way, but soil structure is improved as time goes on, and the soil becomes more productive and less prone to problems such as erosion. Healthy soil, for most agricultural purposes, has not only plenty of organic matter, but is also well-drained and well-aerated.

The soil ecosystem is dynamic, responding to external changes related to temperature, moisture, and other inputs such as chemicals. However, the process of soil formation is slow and it can take hundreds of years to build up a layer capable of supporting crop growth. Unfortunately soil degradation often occurs in a fraction of this time; for example, serious losses of fertile topsoil can result after only a few days of continued wind or water erosion. Soil conservation is, then, a long-term prospect and it can take years of careful management to improve soil quality or to repair earlier mistakes.

Both the quality and quantity of our soils are critical to the maintenance of our life-support systems. The link between these two aspects is evident when one considers the amount of arable land in Alberta. Only 17 percent of our land base is classed as prime agricultural land (Classes 1, 2, and 3) while another 15 percent is considered marginal; this amounts to 27.9 million acres and 24.5 million acres respectively (see Figure 5). "The same features which made an area suitable for agriculture during settlement later appealed to those involved in the planning and development of towns. As these towns and villages grew, it was inevitable that expansion onto good land would occur" (ECA 1985:6). The result has been increasing pressure on our best land and a loss of significant amounts to non-agricultural uses. Furthermore, many farmers have found themselves in a cost-price squeeze as they attempt to produce more from their land to offset rising input costs. Soil conservation sometimes suffers when



Class 1

No significant limitations for crops.

Class 2 and 3

Moderate to moderately severe limitations for crops.

Other

Severe limitations to no capability for crops, or forage; organic soils.

Unclassified Land

FIGURE 5

Soil Capability for Agriculture

Source : Adapted from Canada Land Inventory 1976

economics dictate that farm management decisions be made on a short-term basis.

Erosion, loss of organic matter and nutrients, dryland salinity, and soil acidification have all contributed to the decline of soil quality in Alberta. It is impossible to estimate accurately the number of acres affected by any one of these problems, let alone produce a total of the amount of land affected. It is known, however, that the costs to Prairie farmers are millions of dollars per year, not only from the extra inputs that are needed in the form of fertilizers and fuel, but also from lost productivity of the land. The practice of summerfallowing has been frequently linked with a decline in soil quality, contributing to erosion, dryland salinity, and a decrease in organic matter.

Agriculture has been a way of life for many Albertans for a long time and its contribution to the provincial economy is a major one. Maintaining the quality of our agricultural soils is therefore important not only to farmers but to the thousands of other people whose jobs rely on a viable agriculture industry and to the millions to whom we export our agricultural products. On paper, agriculture would seem to be the most obvious of all sustainable developments, but the crucial requirement is improving and maintaining both the quality and quantity of our agricultural land base at a cost we can afford.

Water

One of the axioms of ecology, it has been said, is that "everything is connected to everything else". Nowhere is this more evident than in issues related to water. Bodies of water are nearly always the ultimate receptor of materials added to air or land, although these materials may be in a different form than when they were initially used. Nevertheless, the addition of agricultural, industrial, and domestic chemicals and waste products to our water bodies has in many areas resulted in a decline in water quality. The combined

effects of such a variety of additions are not well understood and it is difficult for scientists and decision-makers to ensure that safe standards are set for the multitude of new chemicals developed every year.

The interconnectedness of resource uses is also obvious in considering the impacts of other activities. Water quality problems can occur as a result of inadequate conservation in other areas. For example, eroded topsoil can end up in streams or rivers, interfering with fish spawning beds, clogging irrigation canals, and silting up reservoirs. Previously applied agricultural chemicals can be carried along with topsoil particles and these can also have effects. Forestry operations, if improperly planned and carried out, can increase the amount of runoff too, creating erosion problems and jeopardizing watershed stability. Sustainable use of our forests must take into account the essential role of forest ecosystems in replenishing groundwater, protecting watersheds, and preventing soil erosion.

Many projects that alter the environment, including those that involve the removal, diversion, or storage of water, have implications beyond the obvious purpose; in other words, it is impossible to do merely one thing. Drainage projects, flood control efforts, and the building of dams and reservoirs all have effects in addition to solving the problem for which the project was designed. Furthermore, the group or individual who receives the benefits may not be the one who bears the costs, whether these are monetary or intangible. It is important when making major decisions such as these to anticipate what the other effects might be and to then consider the long-term costs and benefits of all aspects of the project.

As with soil, both quality and quantity are important aspects of water management. Water is a requirement for the continued existence of humans and most other species, and a clean, adequate supply must be assured. There are many demands for water in Alberta for domestic, industrial, agricultural, and recreational uses, and we are reminded of the importance of water to our lives when droughts occur, as in the

last two years in southern Alberta. We have an overall abundance of fresh water, but it is not distributed evenly, and there are a number of areas where excessive demand causes chronic water shortages. Exploring ways to adjust the demand and supply is a challenge for the people of Alberta. We must ensure that the decisions made are in the best long-term interests of the province and all its residents, and that actions taken now do not foreclose future options.

Air

Ambient air is a mixture of gases, normally comprising 78 percent nitrogen, 21 percent oxygen, and small amounts of carbon dioxide, hydrogen, and other gases. Other naturally occurring components include suspended particles and water droplets.

Air quality concerns in the past have often focused on urban air quality, particularly in larger centers where traffic is congested, and on areas downwind of industrial activity and atmospheric emissions. Vehicles are a major source of acid-forming emissions as well as lead and hydrocarbons. Lead is known to accumulate in the blood and considerable evidence links lead with learning disabilities and other health problems in both children and adults. Although lead additives are being replaced by other anti-knock compounds, there is some concern about the potential effects of these replacements. Also, many older model cars are designed to run on leaded fuel, and until these vehicles are phased out and the planned new standards are in place, lead will continue to be present in vehicle emissions. Controlling emissions of nitrogen oxides from mobile sources is proving to be a more difficult task than controlling emissions from stationary sources, and research work is continuing in this area.

Natural emissions such as volcanic dusts and smoke from forest fires, and other atmospheric additions such as pollen and sea spray, have occurred for centuries. However, industrial development has meant a significant increase in the rate at which pollutants, including

acid-forming emissions, are released to the atmosphere and in heavily industrialized areas anthropogenic emissions are much greater than natural ones. Atmospheric pollution is a good example of the interconnectedness of environmental components. Although the initial emissions are into the air, much of the ultimate damage occurs after the emitted particles combine with water vapor and return to Earth as acid rain, snow, or fog.

Much of the historical concern about air pollution has focused on the human health effects, and the situation in Alberta is generally in line with this approach. The sour gas industry in Alberta is a major emitter of sulphur oxides, one of the two dominant acid-forming emissions, the other being oxides of nitrogen. Despite the good record of sulphur recovery here, there have been recurring complaints of health problems in humans and livestock in areas where these plants are concentrated. Because of the complex symptoms, it has been very difficult to isolate problems attributed to sulphur emissions and those attributed to other factors. In 1983, a joint provincial government/ industry research program was set up on a cost-sharing basis to investigate the problem of acid deposition in Alberta, including the effects on human health. The Acid Deposition Research Program recently announced two major components of their seven-year plan. A Medical Diagnostic Review is probing in depth the human health concerns of residents in southern Alberta, and a biophysical research program is gathering information on the sources and amounts of acid-forming emissions in Alberta to make a preliminary assessment of the potential effects.

A global atmospheric problem to which Alberta contributes, as does any region that burns fossil fuels, is the build-up of carbon dioxide, colloquially known as "the greenhouse effect". Carbon dioxide (CO_2) plays an influential role in the Earth's climate. Not only does it allow entry of most of the incoming short-wave solar energy, but it traps much of the long-wave energy that the Earth's surface radiates out. The overall effect could be that we will have a warmer global climate in the future. Since 1850, the concentration of atmospheric

CO_2 has increased by nearly 30 percent, due primarily to the combustion of fossil fuels (Myers 1984: 116). This trend is expected to continue and although not everyone agrees on what the implications might be for a particular area, it is clear that rainfall patterns will be altered, affecting agricultural production, and that low-lying regions could be inundated as polar ice melts and sea level rises. The political disruption resulting from such climatic changes could be serious, as some nations or regions that are more or less self-sufficient in food or that rely heavily on agriculture export earnings may find themselves facing new production difficulties over which they have no control. Forestry and other natural resource industries could also be in trouble if major climatic changes occur. Some experts believe that already it may be too late to stop the CO_2 increases from significantly changing global climate patterns; if this is the case, then serious research must be undertaken to determine as best we can what the effects will be and the areas that will be most affected. Use of alternatives to fossil fuels must be encouraged, and deforestation reversed on a global basis, since forests (and vegetation in general) consume vast quantities of CO_2, acting as carbon "sinks".

The question of major climatic change is a complicated one and experts do not agree among themselves on what the outcome will be. Increased amounts of particulate matter in the atmosphere might lead to a temperature reduction by blocking the path of infrared rays from the sun to the Earth's surface, and this change in the opposite direction could have equally disturbing effects on our planet.

Conclusion

Two underlying currents run through any discussion of our ecological processes and life-support systems. One is that all of our ecosystem parameters are connected and it is impossible to alter one component without affecting something else; sometimes the other effects don't appear until much later, and often it is hard to anticipate exactly what they will be. The other point has to do with the implications of our level of energy use.

Many environmental problems are not confined simply to misuse or contamination of one system: soil or air or water. For example, a variety of hazardous waste products have been stored in underground sites, but leakage and other storage problems, such as those now turning up in the Niagara area of Ontario, can seriously damage water and soil. Similarly, acid deposition, which usually starts out as atmospheric emissions, not only reduces air quality but also creates acid conditions in vulnerable soils and water bodies, often with serious long-term consequences for plants and animals. Water management issues also fall into this category, with the Aswan Dam in Egypt being an excellent example of the unanticipated repercussions a major project can have: increased salinity on heavily irrigated farmland, increased disease from water-borne parasites, destruction of the Nile delta fisheries, and most recently a complete shutdown of the brick manufacturing industry because it was competing with agriculture for the use of soil.

Furthermore, some of the most pressing threats to the health of our life-support systems are related to energy use and demand. Acid deposition really boils down to an energy issue, as increases in the rate of extracting and processing fossil fuels to meet greater demand have led to increases in the production of acid-forming emissions. Other energy sources such as nuclear and hydro create concerns of a different nature, but which also have implications for our society and our environment. The agriculture industry, too, is heavily reliant on depleting petroleum reserves for the manufacture of agricultural chemicals and for fuel. Alternatives to synthetic fertilizers and pest control products, or at least a reduction in their use through integrated pest management and use of animal and vegetable wastes, would provide many benefits at possibly lower costs.

Environmental and human health problems can arise in various stages of energy production, regardless of the energy source. Yet it has been argued that a decrease in our energy consumption could affect our standard of living. Energy conservation programs have met with some success, but much of the development in our society has relied on

heavy consumption of energy. The time is rapidly approaching when we will need either to reassess societal values concerning energy use or to find technological fixes for this problem; a realistic solution will probably involve both routes.

Development will not cease in order to accommodate unrealistic demands, nor should it. But a more comprehensive approach to development and conservation is emerging. A Conservation Strategy would focus on sustainable resource development, but such development must be <u>economically sustainable as well as environmentally sustainable</u>. Fortunately, there is ample evidence to indicate that sound environmental decisions are also sound economic decisions when all the costs and benefits are considered. And this is the key. Too often, the so-called common property resources such as air and water, are assumed to belong to everyone and therefore to no-one. Consequently they are under-valued and assumed to be available for the benefit of any who take advantage of them, with little or no thought given to the costs that may accrue to others.

Admittedly, many of these are not problems we in Alberta have had to face with any urgency. But this is all the more reason why it is imperative that we use our natural advantages, including this lead time, to think carefully about the kind of environment and society which we would like to see in our province. Preparation of a Conservation Strategy for Alberta, based on integrative decision-making and long-term planning, would give us the opportunity to avoid making the same mistakes others have made.

Objective 2. <u>To preserve genetic diversity</u>

The tremendous diversity and variability of living organisms on our planet is a source of considerable existing and potential wealth, both aesthetic and financial. Variability exists not only among different species but also among individuals of the same species, and among different populations of the same species. Diversity is also

affected by numbers since the fewer individuals there are, the less diversity there will be. All these kinds of variability better the chances that a species will be able to survive and respond to changes in its environment. Even so, different species respond to environmental changes in different ways; for all, however, the measure of their success is survival. Consequently, species that are unable to adapt to the environmental changes thrust upon them will perish, and extinctions of species have occurred for as long as there has been life on Earth. Some of these, such as the extinction of the dinosaurs, have been very dramatic and the subject of considerable scientific research and speculation; many other species and groups of species have disappeared without note.

Herein lies one of the major problems we face when trying to deal with the conservation of plants and animals: on a global basis, we know about only a small portion of the total number of existing species, so we can't even produce an accurate estimate of how many are being lost. It is impossible and unrealistic to save all species, but prudence suggests that we at least try to assess what is there. Although we know that some of our wild species, especially plants, have been extremely valuable in improving the quality of human life, many more have not even been identified, much less studied. We "use" wildlife in different ways and on different levels, and a species is not useless just because it is not now important for agriculture or industry. We enjoy many wild plants and animals for their beauty and for a host of other, less tangible reasons. Keeping the option open for future generations to enjoy these species should also be a major reason for preserving genetic diversity.

Why Preserve Genetic Diversity?

Outwardly there appears to be a great deal of diversity among species, and sometimes among individuals of the same species. But the genetic make-up of even apparently identical individuals is astonishingly singular. A single organism can have hundreds or

thousands of genes, all of which influence inherited characteristics such as height, hair color, and disease resistance. The total number of ways in which these genes can interact is staggering, and it is this genetic potential, often unexpressed, that determines the ability of a species to react to environmental pressures.

Genetic diversity of individuals is important as a source of variability for a population or species, but species diversity is also important. A complex ecosystem comprising many different kinds of organisms is generally considered to be more stable and less prone to permanent disruption. The various biological components are in balance and will tend to stay that way unless the system is upset by some external factor.

If environmental conditions remain fairly stable, a given population is likely to be stable too. However, as conditions change, only those organisms with a genetic basis for resistance or adaptability will survive. Under previous conditions, the possession of the now-favorable trait or traits was not an advantage, there was no selection for it, and it was likely to have occurred as a result of random mutation. After establishment of new conditions, though, the better adapted individuals would survive to reproduce, and subsequently the favorable trait or traits would be passed on to their offspring.

There are compelling arguments for preserving genetic diversity (Ehrlich and Ehrlich 1981): one has to do with the direct economic benefits we gain from the exploitation of particular species; also, diversity brings indirect benefits gained through the maintenance of natural life-support systems; yet another has to do with the compassionate empathy we feel for our fellow creatures and the capacity of nature to enrich our lives aesthetically.

The practical uses and value of wildlife species (both plants and animals) to people are often referred to as utilitarian arguments. Food production is a major beneficiary of the potential genetic resources of plants and animals. Many wild plants have given rise to

cultivated varieties that are commercially viable. For example, a single weed from Western Europe, Brassica oleracea, provided the stock from which seven vegetable crops were subsequently bred: cabbage, collards, kale, broccoli, cauliflower, brussels sprouts, and kohlrabi (Mathias 1978). Historically, humans exerted an influence on natural selection by actively choosing and planting plants which they deemed most desirable; the taming and breeding of desirable animals followed, with the result that these domesticated plants and animals were soon unable to compete in the wild. Continued selection by plant and animal breeders has improved productivity, but we still rely on the same basic species as did our ancestors thousands of years ago; on a global basis, 30 crops now provide 95 percent of human nutritional needs, and a mere eight, led by wheat, maize, and rice, supply 75 percent of our diets (Myers 1984). This represents less than 0.1 percent of the 80,000 known edible plant species, and our meat and milk are supplied by an even more limited range of species (see Figure 6).

The agriculture industry has teetered for some time on a very narrow genetic base. Intensive selection for high-yielding varieties and crop uniformity has further narrowed the genetic base of modern agriculture; for example, only four varieties of wheat produce 75 percent of the crop grown on the Canadian prairies, and more than half the Prairie wheatlands are devoted to a single variety (IUCN 1980). Only four varieties of potato provide 72 percent of total U.S. production, while just two varieties meet U.S. pea production (IUCN 1980). The situation in the livestock industry is similar, with a very small genetic base being particularly evident in the dairy and poultry sectors. In the beef industry, however, there has been recent interest shown in taking advantage of the genetic potential of the bison. Bison are known to yield better than beef cattle, from poorer land, and with fewer management problems, and their meat is said to be higher in protein and lower in cholesterol (Allen 1980). Some breeding and domestication programs are already in place to use these advantages and it remains to be seen how widespread the practice becomes.

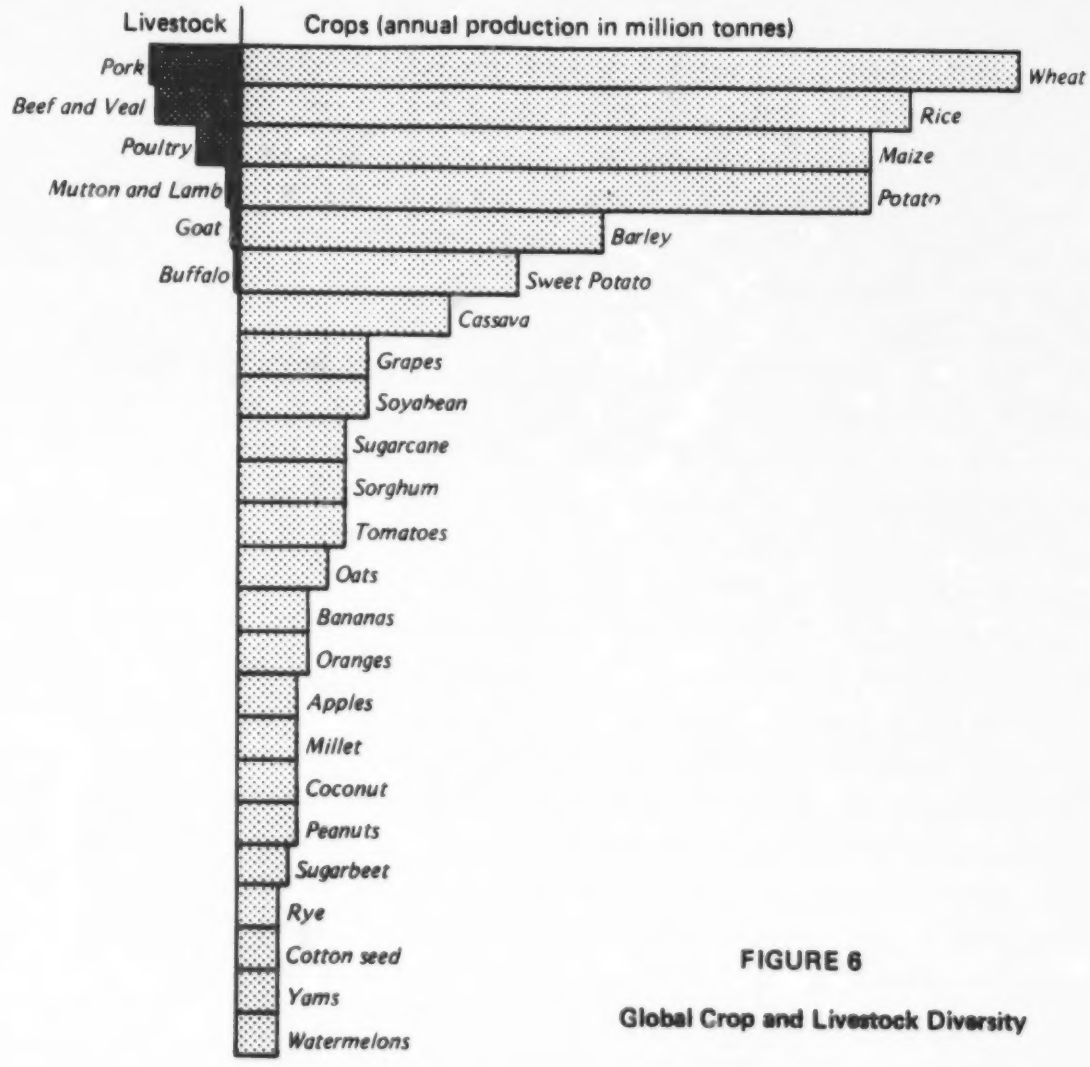


FIGURE 6

Global Crop and Livestock Diversity

Source : Myers 1984

Agriculture has benefitted in the past from regular infusions of wild genetic material when a particular cultivated variety has succumbed to pests, disease, or drought. The wild Peruvian tomato, for example, was found to be resistant to Fusarium wilt, and without the successful incorporation of this trait into domesticated tomatoes, many of our modern varieties would not have remained viable (Myers 1984). Plant breeders and farmers must be ever-vigilant as such infusions are required on a continuing basis; pests and diseases adapt with amazing speed to new cultivars, and it is not unrealistic to expect that disease resistance will collapse from five to fifteen years after the resistant variety has been developed, depending on climatic and growing conditions (Dasmann et al. 1973).

The rapid reproduction rate of many insect pests allows resistance to pesticides to develop in whole populations in a relatively short time. Those few individuals that are inherently resistant to a particular pesticide will survive, reproduce, and build a new resistant population. Many wild plants have evolved ways of protecting themselves from pests and diseases, and extracts of such plants have been used as insecticides since before the time of the ancient Romans (Balandrin et al. 1985). The desire for safer, effective pest control products combined with improved analytical methods for identification and extraction of these plant-produced chemicals may help reduce our reliance on synthetic chemicals. Many weed and insect pests have natural parasites or predators and the key to successful biological control is to find these organisms and provide favorable conditions for them to destroy or control the pest without damaging other species. Our increasing world population and the vagaries of climate will ensure that pressure on our agricultural systems continues. Wild plants, by virtue of their existence, demonstrate their success at adapting to environmental changes and coping with pests, and wild populations must be maintained and their evolution allowed to continue if future generations are to have access to this resource.

Another utilitarian argument has to do with the value of wild species for medicinal and industrial purposes. Nearly 50 percent of

all prescription drugs are derived from wild species of plants, microbes, or animals, with an annual value of nearly $40 billion (Myers 1984). Steroids and alkaloids derived from higher plants are commonly used in the pharmaceutical industry; these include digitalis, belladonna alkaloids (such as atropine and scopalamine), cocaine, opium alkaloids (codeine and morphine), and quinine. Furthermore, many naturally occurring compounds have served as chemical models for the design and total synthesis of new drugs (Balandrin et al. 1985); aspirin is probably the best known of this group, being a simple derivative of the naturally occurring salicylic acid originally obtained from willows (Salix spp.). Plants have played an important role in many cultures for millenia and their value to medicine and pharmacy is increasing as our analytical procedures improve.

Animals too have played an important role in medical science. Snake venom and bee venom have been used in non-addictive pain killers and treatment of arthritis respectively; a Caribbean sponge has provided several derivatives of value in the treatment of diseases caused by viruses. Further, wild animals have been vital to the study and treatment of some human diseases; among these animals are the manatee, which has provided new insights into haemophilia research because of its slow-clotting blood, and the armadillo, the only other species known to contract leprosy. Researchers have also been investigating the African lungfish, an animal capable of relaxing to the point where its vital functions slow drastically; it is thought that this is due to a substance secreted into the blood, a substance that could be of enormous benefit in major operations such as open-heart surgery.

Industrial uses for wildlife are at least as numerous as the medicinal uses. Many industries have used plants and animals and their derivatives for some time, and the products include everyday items such as paint, soaps, plastic, building materials, food flavorings and other additives, and many more. Furthermore, the knowledge we have gained from observing wild animals has enabled us to imitate them and has led the way to useful technological innovations. The discovery that polar

bear hairs are not white but are tiny translucent tubes, the insides of which reflect visible light, explains their very efficient heat absorption; this knowledge could be used to improve the design of cold-weather clothing and to increase the efficiency of solar energy collectors (Allen 1980).

Rising costs and dwindling supplies of petroleum have caused scientists to turn to renewable sources for replacements for petroleum products. One of the major breakthroughs is development of the jojoba plant that grows wild in the deserts of the southwest United States and northern Mexico. The oil from jojoba seeds has properties similar to those of sperm whale oil, and commercial production of this plant could ease substantially the pressure on sperm whale populations as well as providing a viable industry for many native people in the area (Allen 1980). Other efforts to develop petroleum substitutes have focused on the use of plants for fuel. One promising species is the giant ipilipil (Leucaena leucocphala), a plant that is widely grown in the Philippines; it is very fast-growing, reaching 11 feet in six months and almost 49 feet in six years (Allen 1980). Another way of "growing" gasoline is to grow plants that secrete latex, an emulsion of water and hydrocarbons. "The most promising are several species of Euphorbia that are rich in hydrocarbon materials. Small-scale experiments suggest that a one-hectare plot could produce 2,800 to 14,000 litres (740 to 3,700 gallons) of oil per year at a cost of $20 per barrel" (Allen 1980: 107).

Natural ecosystems also play a role in maintaining our life-support systems, as described in the previous section, and many wild species play an important but often low-profile role in other activities; for example, bees and other insects pollinate many of our agricultural crops and other commercially useful plants. Other organisms are excellent environmental monitors, revealing the effects of toxic substances and other contaminants long before the effects appear in humans. Herring gull eggs in the Great Lakes have been used for some time to test for pesticide residues, and marine molluscs have also been excellent pollution monitors. Still others are helping

scientists reconstruct the history of life on Earth, a puzzle that still has many missing pieces.

The ethical and aesthetic arguments for maintaining diversity are more difficult to quantify but are also important. People all over the world go on holidays to enjoy nature and escape from their normal, often hectic, way of life. Wilderness and wildlife provide a change of pace and an opportunity for solitude and reflection that is not easy to value in monetary terms. However, the fact that people are willing to spend considerable sums of money to engage in wildlife-related activities suggests that these things are very valuable to them. The diversity of plants and animals around us may not be something we even consciously notice until we go to a place where it is missing. If, for example, all dogs were to disappear except for French poodles, we could say "the dog" had been conserved, but think of the loss in diversity. The wild kingdoms of plants and animals are even more diverse and it would be an uninteresting world indeed if their diversity were to be much diminished. Many people also believe that humans have a moral responsibility as planetary stewards to protect our wild creatures. Much of this attention and many of the ethical arguments have focused on the more exotic and charismatic animals, particularly large mammals, with varying degrees of success.

How Is Genetic Diversity Lost?

More than 90 percent of all species that have ever lived have disappeared, but the rate of disappearance has increased significantly in this century. It is estimated that there now exist between five and ten million species, the great majority of which are invertebrates; there are about 45,000 species of vertebrates, perhaps 500,000 species of higher plants, and around 100,000 species of lower plants (Balandrin et al. 1985; Myers 1984). Botanists have reason to think that the total number of plants threatened with extinction is about 25,000 species. Further, they have estimated that between 20 and 40 animal species depend on each plant species for their survival; thus for every

plant that disappears, many more animal species may be threatened (Myers 1984).

Despite the continuing role of natural disasters and climate in influencing plant and animal communities, the effects of human activities have been much greater. Since human beings arrived on the scene in large numbers, our influence has been felt in every part of the globe. Although the numbers of some species have been depleted by market hunting and poaching, the modification of habitat in its various forms is the most serious of all threats to living resources. Habitat modification occurs when land is cleared for agriculture, industry, or resource extraction; when major projects such as dams or highways are undertaken; when contamination results from effluent disposal or emission of toxic chemicals; when too many tourists are allowed access to sensitive areas such as alpine meadows or sand dunes; or when new, non-native species are introduced and competition results in displacement of the indigenous organisms. Selective removal of species to provide shelter or food for other organisms also results in habitat modification and in extreme cases can lead to local extinctions because the dependence on that particular species is so great.

When a stable community or ecosystem is disrupted and the habitat modified, the way is open for opportunistic new species to move in. These organisms are efficient competitors and the speed with which they are capable of becoming established is evidenced by the number of weeds around construction sites and other disturbed areas. The same thing happens with animal species too; not infrequently pesticides remove desirable species as well as the target organism, with the result that space is created in the community for other species to move in, some of which may be even worse pests.

Exploitation of wild animals for their furs, body parts, and meat is a serious problem in a number of countries, and some efforts have been made to curtail international trade in these products. This issue, however, goes beyond the technicalities of conservation and into economics, culture, and religion. Efforts to save species threatened

by this form of exploitation should acknowledge these other factors and explore alternatives to the use of these species.

How Can Genetic Diversity be Preserved?

One way to approach the problem of over-exploitation is through international agreements. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) now has 89 signatories, including Canada (IUCN Bulletin 1985:75) and has been in force since July 1975.

> "The key to the usefulness of CITES is its network of national management authorities and scientific authorities operating in direct communication with each other and the secretariat ....Effectively, therefore, CITES both regulates international trade in wild species and places an obligation on governments to monitor the status of species" (Allen 1980: 115).

The World Heritage Convention to ensure protection of unique natural and cultural areas and the Convention on Migratory Species of Wild Animals are two other strong global agreements. The Migratory Species Convention, which obliges its members to protect endangered species and to make special agreements for the conservation of those species whose status is "unfavorable", is very important; nevertheless, it has been slow to be accepted, mainly because it covers fish and other migratory marine animals (Allen 1980). Only 15 countries have signed this Convention, which came into force in November 1983, and Canada is not among them (Myers 1984). However, Canada does have a treaty in place with the United States and Mexico to protect migratory birds.

Although over-exploitation can be a significant local or regional problem, habitat loss and modification are more serious on a global basis, and this includes North America. Settlement, expansion of agricultural land, industrial development, and resource extraction activities all can have major impacts on the habitat of wild plants and

animals. Alternative sites for such activities should be explored whenever possible to preserve sensitive or essential habitat.

Formally, there are three major ways to preserve genetic diversity and prevent the extinction of species:

1. the organism(s) can be protected "on site" by preserving the ecosystem in which it naturally occurs;

2. part of the organism, such as the seed, semen, or other cells from which the organism can be reproduced, can be stored "off site" in a gene bank;

3. the entire organism(s) can be maintained "off site", outside its natural habitat, in a zoo, botanical garden, plantation, aquarium, or culture collection.

It is necessary when addressing the loss of genetic diversity to remember that the number of individuals of a particular species is also critical. The gene pool and thus the potential for diversity are much greater when there are many individuals available to breed, and this is an important factor when habitat conservation is being considered. Furthermore, many species do poorly in confinement and for these reasons, the second and third options above should not be considered equally desirable alternatives to the maintenance and protection of natural habitat, although they can play a vital role when ecosystem preservation is not possible.

The establishment of protected parks and ecological reserves allows larger populations to maintain themselves and, equally important, allows natural selection to continue uninterrupted. Furthermore, on-site reserves can function as living laboratories, allowing researchers to observe characteristics that might otherwise be overlooked or not be expressed under formal laboratory conditions.

Conclusion

Most plants and animals threatened by habitat destruction occur in freshwater, wetland, tropical forest, and Mediterranean-type environments (Allen 1980). Although these may seem far removed from Alberta and appear to have little relevance to us, wildlife is a global heritage. Our natural resource industries such as forestry and agriculture will continue to benefit from research on genetic transfer and improvement of their crops using traits of wild species; the petroleum industry could find that the development of petroleum substitutes will extend the lifetime of our oil and gas reserves; and all citizens of the world will continue to benefit from the pharmaceutical and medical properties of wildlife species. Furthermore, multi-national companies often are involved in resource development in areas where wildlife species are threatened, and the products of these developments are used in our country too. The routine use of environmental impact assessments prior to the establishment of large projects could help to identify problem areas and reduce the impact and extent of habitat modification.

Policies to protect our wildlife heritage can be very difficult to implement. Often in areas where protection is most needed, the resources to ensure protection are most limited. Also,

> "one of the things that makes it difficult to formulate a policy for endangered species is the inability to determine on a species-by-species basis what mankind gives up if a species is forever lost. At the same time, we do know that the larger the numbers of species that are lost in a particular area as a result of natural forces or human intervention, the more likely it is that something of potential value will be lost. This is relevant since certain human activities, particularly tropical deforestation, can imperil large numbers of species at one time" (Harrington and Fisher 1983: 121).

Anticipatory policies and assessments could prevent or mitigate many of the damaging effects that result from poor planning. Consideration of the "big picture" and keeping in mind the complexity and interconnectedness of natural systems are essential parts of

planning for development and conservation. Of the three major options for preserving genetic diversity, maintaining wildlife in its natural setting is clearly the most desirable and the most difficult. Anticipating the impacts of development to prevent critical habitat loss in the first place makes more sense and would almost certainly be the cheaper alternative in the long run.

Molecular science has made tremendous advances in the last decade and our knowledge of genetics and the transfer of biological information has grown exponentially. It is ironic indeed that even as we are beginning to realize the contribution that wild species could make to the improvement of our quality of life, we are busily destroying thousands of acres of habitat every year, and losing unknown numbers of species forever. Protecting critical habitat now does not preclude its development at some future time; it does mean that we are keeping our options open and avoiding a decision that could have irreversible consequences.

More and more people are discovering that quality of life is more than just what has been called our "standard of living"; the things that enhance our quality of life are often things which money simply cannot buy, and enjoyment and appreciation of wildlife falls into this category. Once a beautiful orchid or a lithesome wild cat has disappeared, no amount of money will bring it back.

Wild species have been used for as long as human beings have inhabited this planet, and it is unlikely to stop now; although a number of species are threatened, we must also remember that extinctions have always been a part of the natural order. Furthermore, we must also acknowledge that the World Conservation Strategy focuses on sustainable use, not non-use. The challenge for the world community will be to determine quickly and as best we can the species that are threatened and should not be harvested for human use, and those that are capable of sustained use.

Objective 3. To achieve sustainable use of species and ecosystems

Introduction

The World Conservation Strategy states that the need to ensure that utilization of living resources is sustainable varies with a society's dependence on the resource in question. For a subsistence society or for one that relies on one or a few crops, sustainable utilization of its resources is essential. The greater the diversity and flexibility of the economy, the less the need to utilize certain resources sustainably — but by the same token the less the excuse not to. Sustainable use is also necessary for the rational planning and management of industries dependent on the resources concerned. "A society that insists that all utilization of living resources be sustainable ensures that it will benefit from those resources virtually indefinitely" (IUCN 1980: 4.1). Unfortunately, current human utilization of many species and ecosystems is not sustainable.

Ecosystems consist of plants, animals, and micro-organisms as well as the air, water, and soils that support living organisms.

> "Any assemblage of plants and animals able to exist within an area will in time form a biotic community. In this community the different species tend to interact with one another and to modify the conditions of life within which each exists. They therefore develop the inter-relationships and interdependencies which constitute an ecosystem....An ecosystem is essentially a biotic community in interaction with its physical environment" (Dasmann et al. 1973: 28-29).

Usually one group of species dominates a given ecosystem, such as trees in a forest grove or grasses in a grassland, for example.

The size and complexity of ecosystems vary a great deal, but a common feature is that all are dynamic. In general, natural ecosystems comprising many diverse species are more complex and more stable, exhibiting a greater resilience to disruption. Simpler, less diverse ecosystems, such as agricultural ecosystems or forest plantations, do

not have the same degree of resilience and require continuous artificial inputs to maintain their simplicity and stability.

All ecosystems together form the biosphere, a complex web of life and its support systems.

> "Man is a part of the biosphere and depends on its continued functioning for his own existence. He can modify or even destroy any one ecosystem. He cannot, however, risk major modifications of the biosphere except at the risk of his own extermination" (Dasmann et al. 1973: 30).

Sustainable use of the biosphere is the key to this continued functioning. Indeed, without sustainable use, depletion and collapse of the resources upon which we depend is inevitable, and this should provide considerable incentive for all societies to work to reach this critical goal.

A resource is being used sustainably when it is consumed at a rate not exceeding that at which it can be renewed by natural processes, aided in some cases by human intervention in the form of pest control, irrigation, crop rotation, and so on. In other words, sustainable use is analogous to living on our ecological "interest" and maintaining the "capital". Unfortunately, resource use in many instances has been drawing heavily on capital; our present use of grassland, forest, and fisheries resources provides good examples of what has been called the biological equivalent of deficit financing. With biological systems as with economic ones, this "borrowing against the future" cannot continue for long.

Due to the dynamic quality of ecosystems, their health and productivity are variable; natural and man-made disasters, cycles of pests or predators, and a host of other factors can influence them. When levels of sustainability are being determined, it is necessary to allow for this seasonal variation so that over-use or excess harvesting does not occur. Achieving sustainable use after a period of mismanagement or overexploitation is especially difficult since many biological systems take a long time to recover from the effects of

depletion, pollution, or other adversities. In fact, overexploitation, even for the relatively short period of a few years, can deplete a resource such as rangeland or fisheries to the extent that it will never recover. Other species move in to fill the vacant place(s) in the ecosystem resulting from overuse, and the desirable species may never regain its former position.

Because many ecosystems are used for more than one purpose, sustainable use considers and maintains these multiple uses to the extent possible. A forest ecosystem, for example, serves many functions in addition to providing raw timber: forests play an important role in watershed protection, they control runoff, provide habitat for many wild species, and offer a variety of recreation opportunities. Furthermore, improper management or abuse in any category can affect the ability of the ecosystem to sustain the other uses.

Sustainable use is important to Alberta for many reasons. As we have seen, our province was initially settled on the basis of natural resources, and these continue to play a leading role in our economy. In fact, although Alberta's economy has diversified to some extent, this diversification has been for the most part in resource-related areas and essentially we are still dependent on our renewable and non-renewable resource base. The petroleum industry, forestry, agriculture, and tourism form the cornerstones of Alberta's economy, the latter three depending on species and ecosystems considered to be potentially capable of sustained use. Also included in this category are recreation and other wildlife-related activities.

Society's attitudes towards the resources that are capable of sustained use vary, and this is reflected in the different patterns of ownership and management which have evolved for each resource. In Alberta, most farmland is privately owned and managed, although a significant portion of public land is made available for grazing through the issuance of leases and permits. Forests, on the other hand, are found mainly in the Green Area, which is public land, and

forest companies can obtain various dispositions for timber rights on these lands. Wildlife resources are considered to belong to the Crown and are managed as such. However, in many cases, important habitat is found on privately owned land, creating a dilemma for farmers who may feel that they need this land for their farming operations. There are concerns about the long-term sustainability of all of these resources, and the questions of resource ownership and management should be addressed when solutions are being sought.

Agricultural Ecosystems

Agricultural ecosystems around the world are manipulated by human beings. Whether used for growing crops or for grazing, agricultural land represents a modification of the land base for the purpose of food production. These systems have been simplified so that one or a few desirable species are encouraged to the exclusion of others and, as a result, continued inputs are required to maintain their stability.

Alberta has significant amounts of agricultural land dedicated to both cultivation and grazing. Cultivated land is used largely to produce grain, oilseed, and forage crops. Increased specialization and mechanization since World War II have meant that farms have become larger in size but each farm now tends to produce a smaller variety of crops. Monocultures are the norm and this means that farmers must constantly ensure that their crops are protected from pests and disease and that adequate nutrients are added to their fields. As soil nutrients are removed in harvest, farmers have come to rely more and more on synthetic fertilizers to sustain their crops and this has added significantly to the costs of production. Cultivated cropland represents an artificial ecosystem in the sense that these plant associations would never occur naturally nor would they survive without continual human vigilance.

Agriculture as we know it today relies heavily on inputs of energy in various forms to be sustainable. As supplies of fossil fuels are

depleted, prices will increase, a trend that has already caused difficulties and higher input costs for farmers. If agriculture is to survive, changes in attitudes and approaches will be necessary. Admittedly, this period of major change still may be some time away, but it is nevertheless inevitable. Alberta is in an advantageous position in that some of the revenues from our petroleum resources could conceivably be directed towards the search for alternatives the agriculture industry of the future could use to remain viable. In this way our non-renewable resources are integral to the conservation strategy concept and the prospect of sustainable development.

Grazing lands too have been heavily used for the production of cattle and other livestock. Globally, grassland ecosystems have developed in areas that tend to be somewhat arid, and overuse of what are often common pastures has led in some cases to serious desertification and removal of desirable forage species. Overgrazing is aggravated by shortages of rainfall, which occur on a regular basis in grassland ecosystems. Native prairie grasses are well-adapted to the variations in moisture typical of these areas, but in Alberta, as elsewhere, many of the native grasslands have been plowed under and replaced by cultivated crops or by tame pastures that require better management and more inputs to remain productive.

Much of Alberta's agricultural land base is better suited for grazing than for cultivation and, in terms of soil conservation, it would be wise to leave a grass cover on significant portions of land that are prone to soil erosion. However,

> "rangeland management must be based on the expectation of drought. Some of the most serious land use failures have resulted from the expectation that the above-average precipitation of a wet cycle would continue indefinitely. This has occasionally led to ploughing and cultivation of lands that could not permanently support farming and, more generally, to serious overstocking in the course of attempts by livestock owners to ride out what they hope will be a brief drought period. The end product has been the "dust bowl", depleted lands, and spreading deserts" (Dasmann et al. 1973: 79).

Acceptance of the limitations imposed by climate and the subsequent adoption of appropriate dryland range management practices would do much to ensure the sustainability of our grassland ecosystems.

Our agriculture industry of today is primarily oriented towards food production. However, as depleting petroleum reserves create higher priced energy, there will be more incentive to find alternative sources. One alternative is to grow crops for energy production, as is already occurring in some parts of the world. This practice has many social and ethical implications, as well as implications for the agricultural land base, and could lead to increasing pressure on food-producing areas if farmland is usurped for energy production.

Forest Ecosystems

Much has been written about the crisis in forest management, and there is a great deal of concern that our forests are being depleted considerably faster than they are regenerating. This is true on both a global and national level, and has serious environmental, economic, and social implications. Tropical rainforests in particular are suffering from over-exploitation as a result of population resettlement, shifting agriculture, timber harvesting, and ranching. In many countries, wood is the chief source of fuel, and population increases have put more and more pressure on local supplies. Depletion of the forests in this way has created a host of other problems including soil erosion, flooding, and reduced supplies of drinking water.

The forests of Canada and Alberta are a major component of our economic structure. The forest industry employs a large number of people directly and indirectly in the processing and manufacturing industries, and our forest products have traditionally been a source of considerable export earnings. Indeed, from a strictly utilitarian viewpoint, it is hard to imagine what our lives would be like without wood products; common items from facial tissue and newspaper to furniture and construction materials are products of our forests, and

these items never seem to be in short supply. Yet, we as a nation are now harvesting a heritage of timber that has taken many years to mature, and even if these trees were being replaced one for one, it would take many more decades for them to reach a marketable size. To achieve sustainable use of our forests might require a reduction in the harvest at least until reforestation programs and policies in other parts of the country have caught up.

The Alberta Forest Service manages our forests on a sustainable-yield basis, but programs to encourage recycling would help to reduce the demand for virgin forest products; Canada's record on recycling of paper is quite mediocre. Only about 20 percent of our paper consumption comes from recycled waste paper, a figure that pales when compared with the recovery rates of countries such as the Netherlands (44 percent) and Japan (47 percent); even Sweden, with its extensive forests, has a recovery rate of 33 percent and U.S. recovery is at 27 percent (Chandler 1984: 99).

The multiple use and nonmarket value of forests are also factors to consider when discussing sustainability. Alberta's forests provide a variety of recreational opportunities and wildlife habitat and are critical in maintaining many of our essential ecological processes.

> "Sustaining the forest resource base involves defining the socially optimal magnitudes and mix of wooded lands — old-growth natural forest, natural or artificially regenerated forest, plantations, and woodlots — that will both allow demand for wood products to be met without depleting the forest capital and preserve the essential nonmarket values of the forest ecosystem" (Postel 1984: 90).

It will be a challenge to manage our future forest resources so that timber production as well as the other uses are maintained, as demands for all the products of the forest expand.

Wildlife

The wildlife resource has a number of components, all of which have their own roles and importance to Albertans. Fur-bearers provide an income for the several thousand trappers in Alberta, and hundreds of thousands more people use the wildlife resource through hunting and fishing or by simply observing. For some Albertans, subsistence hunting and fishing are essential.

Management of this resource by the Crown is made difficult by the increasing demand and by the situation of land tenure described earlier. Some of these problems have become more apparent in recent years; for example, in severe winters, deer sometimes feed on farmers' hay supplies, and decisions must be made about the best way to manage this conflict. Ensuring sustainable use of the wildlife resource is further complicated by losses of habitat as wetlands, woodlots, and shelterbelts are removed to allow cultivation. Serious declines in migratory waterfowl populations have resulted from a combination of drought, hunting, and loss of habitat; the latter two factors can be controlled, and recent announcements that the number of birds taken will be reduced and that incentives will be provided to encourage farmers to retain wetlands should help to restore the populations.

Wildlife resources, perhaps more than agriculture and forestry, are subject to seasonal and annual variations. Therefore, policies aimed at developing sustainable use must be flexible enough to account for this variability and look at long-term implications. As with the other resources, the broader effects must be anticipated, since a decision to do one thing can have major impacts on other components of the ecosystem. Human intervention to control pest species, the decision to supplement feed for wild animals in severe winters, the commercial raising of game animals, and the removal of habitat are examples of actions that can have consequences far beyond what was intended. Alberta has taken major steps to identify its objectives in wildlife management through the development of the Alberta Wildlife Plan. The next challenge will be to translate targeted numbers into effective

management procedures that maintain wildlife populations at levels close to the projected goals.

Tourism and Recreation

Although tourism and recreation are not consumptive uses of species and ecosystems in the sense that a resource is being harvested, healthy ecosystems provide the basis for a large part of Alberta's tourist industry, and many of the recreational activities in which Albertans themselves engage rely on the use of our outdoors. Alberta's diverse biogeographical features provide a beautiful and environmentally stimulating background for outdoor recreation. Tourists from all over the world visit our national parks and heritage sites, which were initially set aside as being worthy of preservation and protection. Ensuring their sustainability and protection for future generations to enjoy might mean that in some cases the number of visitors should be limited or that access to areas of heavy use may have to be controlled. Facilitating access to other areas could also ease pressure in popular locations. Excessive use of this resource can lead to its depletion and diminution just as it does for any other resource, and the effects of too many people can be manifest in many, often unforeseen ways. Sewage and water treatment requirements, the need for more and bigger highways, and expansion of other tourist facilities all put pressure on natural resources, and demand very careful planning to maintain a balance and prevent resource deterioration.

The great value, both economic and intrinsic, of our natural resources is not being "wasted" by non-intensive use; on the contrary, this allows the value to accumulate like interest in a bank account, while overuse often diminishes the capital itself. In the end, it is the clean lakes and rivers, the forests, and the uncluttered views that many people come to experience, and encouraging heavy use by over-development can spoil the very things people want to experience. In this case, those concerned about conservation and those interested

in development are really talking about maintaining and protecting the same resource.

Conclusion

Progress towards this objective, out of the three discussed in the Wordl Conservation Strategy, is probably the most difficult to assess. It is possible to "see" soil erosion or air or water pollution and thus possible to see when improvements have been made; similarly, when genetic resources are preserved, as with a park or nature reserve, or when an endangered species is re-established, there is an immediate, obvious result. However, determining when sustainable use of living resources has been achieved is more difficult. Sustainability may need to be redefined over a period of time as environmental conditions, market conditions, and conditions of resource use change; as well, actually seeing results can take years or decades. For example, forests grow slowly and soil formation is also very slow. For this reason, if we are to have any hope at all of reaching the goal of sustainable development, action must be taken immediately. Although it may take time to achieve the goal, we must take the first steps now to prevent further deterioration of our resource base.

It cannot be overemphasized that a broad knowledge and understanding are requisite for the development of anticipatory and pro-active policies for sustainable development. In many cases, particularly in the so-called "developed" world, the knowledge and information base to achieve sustainable resource use are available. The problem then becomes finding the will to implement the solutions, to look beyond the immediate future to the long term. A change in priorities is essential to achieving sustainable development, but historically people have tended not to react or change their minds about things until a crisis is perceived to be at hand. Unfortunately, critical points in environmental and resource management often do not appear obvious to the majority until it is too late to do anything to prevent the disaster. Ancient and now extinct civilizations lived in

an era when environmental tensions mounted slowly and they probably did not understand the forces undermining their economies.

> "We do know what threatens us. But still lacking is the broad public awareness needed to launch an effective response. Without that understanding, the needed shifts in priorities, programs, and funds are not likely to materialize" (Brown 1981: 166).

Much concern in recent decades has focused on our ability to destroy our planet through unthinkable nuclear war. But in this same time period, we have also acquired immense power to protect and sustain life. No other species has the ability and power to affect the biosphere as human beings can, nor to anticipate what the consequences will be, and no other species will make the decisions about how this power will be used. For us to deny our effects, our power, and, perhaps most important, our potential, is futile and counter-productive. It would be folly indeed for us not to make the best use of these advantages for the benefit of all species with whom we share this planet.

Objective 4. To provide for the recreational, spiritual, aesthetic, and other non-material needs of Albertans by maintaining and developing diverse opportunities for the use of natural resources

Although the World Conservation Strategy is concerned primarily with the material well-being of people and the attainment of sustainable development, other, non-material aspects of resource use are also important to our quality of life. These non-material components include many that we may not recognize or acknowledge as contributing to an improved quality of life and, indeed, people in different parts of the world and from different cultures would probably not agree on what the most important non-material aspects are because this is largely a value judgment. Although it is sometimes difficult to discuss what may seem to be frivolous "needs" when millions are

facing starvation or worse, these are nevertheless important to our societal well-being, and the opportunity to fulfil these needs here is one of the things that makes our province such a desirable place to live. For the purposes of an Alberta Conservation Strategy, the non-material benefits of resource use can be grouped into five, not necessarily exclusive, categories:

- outdoor recreation and leisure
- cultural heritage
- educational requirements
- psychological needs
- spiritual matters broadly related to ethics, morality, and religion.

Outdoor Recreation and Leisure

Alberta's varied topography and environmental features provide some first-class opportunities for outdoor recreation and many factors have enabled more and more Albertans to take advantage of these opportunities. More flexible life and work styles, increased mobility, and an increased awareness of the benefits of physical activity have contributed to a surge in participation in outdoor activities, and this interest is not expected to decline in the near future. Increased demand is reflected in the difficulty of finding a camping spot on a summer weekend, long lineups at ski hills in the winter, and the heavy traffic near parks and other recreational areas on weekends year round.

Many more people engage in activities that can be done locally such as walking for pleasure, picnicking, cycling, and swimming, and the heavy use of parks in urban areas attests to the popularity of these pursuits. Recent surveys by Alberta Recreation and Parks indicate that hundreds of thousands of Albertans spend a great deal of their leisure time out of doors, and although their activities might not be strenuous ones, the quality of their outdoor environment is important. Even a small backyard garden plot or a tiny neighborhood park at the

end of a quiet street contribute to an improved quality of life for people in urban areas. Preserving pleasant places in urban surroundings is necessary for those who may not have easy access to rural land or park settings; maintaining open spaces and natural areas in and near cities will become more important in the future as population densities in urban areas increase and fuel prices rise.

Although Alberta has large unsettled areas, these are not necessarily high-quality wilderness or recreational areas. High-quality water bodies are particularly scarce, especially near population centers where demand is heavy. Also, many of the best shorelines are privately owned and access to them is limited. Alberta also has vast tracts of public land to which the public has traditionally had right of access. The continued use of these lands, which are quite desirable for many types of outdoor recreation, would ease pressure on other areas that often receive heavy use as tourist destinations.

The preservation of wilderness is desirable for many reasons; among other things, these lands are valued for the habitat they provide for plants and animals, for their recreational opportunities, and for the fact that maintaining wilderness amounts to keeping our options open. Even people who may not wish to experience wilderness themselves want to preserve this option for future generations; the destruction of wilderness areas precludes their use for many other activities, but preservation does not preclude their development at some point in the future. To many people, simply knowing that the opportunity is there should they wish to take advantage of it is worth a lot.

Cultural Heritage

It can truly be said of our national culture that "the whole is greater than the sum of the parts". Canada has become home to immigrants from many parts of the world, and the richness of our

national cultural mosaic is apparent in Alberta too. Maintaining links with one's heritage can provide an identity for newcomers, satisfy the curiosity of young people about their roots, and can have many other practical advantages in a world that is quickly becoming a "global village".

However, Alberta is barely 80 years old and traditions have not had time to blend and re-emerge in new forms. Therefore, our natural resources and the environment in which we as Albertans and Canadians have chosen to live, play an important role in shaping the attitudes we have about ourselves and in helping us to focus on a common identity; although there may be ethnic and cultural differences, we all have a more recent heritage which is shared and which provides a unifying force for citizens of our country and our province. Albertans have good reason to be proud of their province and this pride is very much related to the natural and human resources found here.

The earliest people in Alberta established close links with the land and had a great deal of respect for the natural forces that affected their lives and, indeed, their survival. However, the concepts of "a land ethic" and "stewardship" and comprehension of the land's carrying capacity are not new; these were understood and practised by natives long before other people arrived. Today, many Albertans are one or two generations removed from the land and their own rural roots, but our affinity for land and landscapes is still evident in other aspects of our culture: paintings, fiber arts, literature, and films often reflect this love of natural surroundings. Alpine lakes, expansive prairie, northern lights, and big blue skies all provoke images of Alberta and these are as much a part of our heritage as oil rigs, grain elevators, and the bison.

These links are important in helping us as human beings to reaffirm our oneness with other humans, including those who have gone before us. A Conservation Strategy should recognize the contribution that preservation of this heritage makes to our quality of life and

ensure that the opportunity for future generations to savor the richness of their past is maintained.

Educational Requirements

Children have a natural curiosity about the world around them, and adults too are often vicarious travellers and adventurers. The enormous popularity of wildlife and nature programs on television, the continuing demand for interpretive programs in parks and natural areas, and the number of nature-related clubs and societies in Alberta are all evidence of the interest in our environment and natural resources. As urban populations grow and our rural links become more distant, it is likely that demand for such information will increase.

Outdoor education programs are already well-established in schools at several levels. These play an important part in shaping the attitudes of our young people towards the environment and in preparing them for careers in the natural sciences. Museums and science centers have also been established in many parts of Alberta, providing a wealth of information about our province's human and natural history. Until relatively recently, science has tended to be shrouded in an aura of mystery and the general public was content to leave science to the scientists. But the presentation of scientific theories and concepts in a more popular form has been a progressive step in informing people about themselves and their world; increasing awareness and a basic knowledge of the interconnected workings of the world around us can meet many of our needs for personal satisfaction and development at various levels.

Many of the decisions confronting modern society have to do with management of our natural resources and maintenance of environmental quality: decisions concerning energy supplies, disposal of toxic wastes, water quantity and quality, agricultural land preservation, genetic research, and so on. An informed, concerned public plays an important role in influencing the decision-making process and attempts

to provide people with accurate information in these matters should be encouraged.

Psychological Needs

Psychological needs, of all the non-material needs, are the most pervasive; these overlap with all the others and in many cases are inseparable. Everyone feels the need for "breathing space" and to experience the fresh air and openness of uncluttered environments at times. Especially for urban dwellers, natural resources and landscapes provide a change of pace, that cannot be found in any other way. In addition to their beauty and grandeur, landscapes and wildlife instill a sense of security and continuity in people. They reassure us of our own place in the natural order and they secure our links with other creatures.

Alberta's landscape has undergone many changes since the days of settlement, and there is concern about inappropriate land uses developing in some areas. Some land uses have specific environmental requirements, while others are less demanding, and particular care is needed when developments are planned and sited. Once a unique spot is lost, it cannot be replaced and activities that can locate in alternate places should be encouraged to do so.

These psychological needs do not always require a pristine environment to be fulfilled, although it is hard to beat a prairie sunset or a quiet mountain morning; many modified environments such as urban parks or agricultural areas will do. Even going for a walk in the middle of a city on a crisp autumn evening can be refreshing and invigorating, if one's security is not threatened. These are important considerations to keep in mind when priorities are being established for parks and recreation areas. Wilderness areas are undeniably very valuable, but setting aside scenic natural places in and near urban areas would help to meet the needs of the more than 75 percent of

Albertans who live there and would also relieve some of the pressure on more sensitive wildlands.

Ethical, Moral, and Religious Matters

There has been considerable philosophic debate over the extent to which our species has a moral and ethical responsibility to other living creatures. Traditionally, if there has been an obvious advantage for humans in maintaining a particular species or population, we have attempted to do so. It has also been easier to rally public support on behalf of the so-called "charismatic megavertebrates" (Foose et al. 1985) — the whales, tigers, and other endangered large mammals about which people often have idealized notions — than it has for endangered plants and less glamorous animals. Attitudes are changing, though, and this is apparent in the activities of many people who now are interested in natural history. Rather than gathering specimens to preserve in collections, we are putting considerable effort into maintaining natural habitats for wild plants and animals.

Moral, ethical, and religious issues strike at the core of our extremely sensitive personal beliefs, and cannot be resolved through a conservation strategy. However, in the development of a provincial conservation strategy, these issues would underlie much of the debate. It is likely that most Albertans believe there are moral and ethical justifications for conservation principles; this may be simply that we owe it to our children to pass on to them the chance to enjoy and use the natural resources we have sustained.

Conclusion

Many of the non-material benefits derived from the use of our natural resources could be considered value judgments, and some might argue that a factory or a coal mine would provide as much pleasure, security, and satisfaction as a mountain stream. The point of a

conservation strategy is that we need both. Since this is the case, we owe it to ourselves to resolve our unending conflicts about how much we require of each in an effective and efficient manner.

These values and the options we wish to keep open lie at the heart of our society's existence. When these value systems are widely held and functioning well, conflict is minimized and the values are not questioned. But when agreements cannot be reached and the system shows signs of stress and wear, underlying values may be called into question. The concepts associated with sustainable development may indeed require a realignment of our values, but the basic principles of a conservation strategy represent ideas and approaches most people would probably say they intuitively believe in. These principles can help us to recognize and establish the common ground between different groups, and to avoid destructive disagreements that occur when people fail to realize that they are saying the same thing in slightly different ways. We already have a great deal of knowledge and information about what could be done to improve our use and management of natural resources and, in many cases, the values and goals of apparently opposing sides are not really so different. We now need to find ways to integrate and define these values and goals so that all interests can be considered in a balanced and beneficial approach to sustainable development.

Objective 5. To maintain and improve the quality of life in the urban environment, where the majority of Albertans now live and work

The establishment and maintenance of viable city regions have paralleled the development of Western Canadian society. Indeed, those places with productive and prosperous cities are also those that have healthy agricultural regions and hinterlands. Historically, cities have played a vital role in the rise and fall of entire nations and, as

the condition of cities changes, so too does the health of a country or province.

Cities, especially those that are healthy and growing, can have a considerable range of impacts on surrounding areas. Depending on the rate of growth and the power and foresight of local planning agencies, the negative physical impacts often can be minimized, while still providing the benefit of the economic opportunities associated with development. For example, cities provide markets for new and different products, they provide jobs and income for many people which in turn generates capital for additional growth and diversification, and they provide new technology that can be applied to increase productivity in adjacent areas, including rural regions.

Cities also provide opportunities for enhancing the quality of life of both residents and those who live in the city region. Educational institutions are traditionally located in urban areas, as are many cultural and recreational facilities. These rely on a large population or "user" base in order to remain viable, but it is not necessary to actually live in the city to enjoy or benefit from it. In fact, the advantages of a first-class medical research facility, a sports team, or a museum can be experienced by people who live many miles away.

Although it may be convenient to group members of our society into categories such as "urban" or "rural", in fact the interests, needs, and activities of people who might be so labelled really do not differ a great deal. All of us must be fed, clothed, and housed, we need clean water to drink and clean air to breathe, and our recreational and aesthetic needs must be met. Those who live in rural areas may send their children to schools in the city, they visit cultural exhibitions and attend sporting events, and they might take advantage of their proximity to a large and diverse urban center to shop. Similarly, those who live in towns or cities often enjoy spending some of their leisure time in the country or wilderness areas. The point is that where we live is not of consequence; we all have an interest in

maintaining the environmental quality of not just our own back yard, but our neighbor's as well.

It is important, then, that any strategy for conservation address not only ecological problems in the usual sense, but also the concerns and issues that face Alberta's urban areas and the 1.7 million people (more than 75 percent of the total population) who live there. Although cities and urban areas constitute an anthropogenic environment, that is, one created by humans, built-up areas should not be regarded as "unnatural"; they are a special kind of ecosystem.

Cities as Part of the Natural Environment

The tendency of people to group together in settlements of some sort is as old as the human race itself. Historically, these settlements were established in areas where there was an assured supply of water and a defensive advantage for the residents. In more recent times, settlement patterns have also been related to transportation routes, availability of natural resources, and the ease with which urban infrastructure could be put into place. We realize that urban areas that respect the ecological characteristics of a region can be constructed; indeed, the incorporation of such sensitivity into city plans can lead to cities that become part of their surroundings rather than the other way around.

As are all natural systems, the human-centered system is dynamic; just as a pond or a sand dune changes with time, so the anthropogenic environment is evolving and responding to change. All species modify their surroundings to a greater or lesser degree, to protect themselves from enemies, heat, cold, or other threats to their well-being, and sometimes these modifications are remarkably similar to the ways humans have altered their ecosystem. A major difference, though, is the rate at which these systems change and the fact that human beings can, to a large extent, influence the direction that their society and their environment take. Human beings not only have expectations that their

environment will change, but they can control the direction and the speed with which the changes occur. The creativity of the human mind has allowed us to harness energy far beyond our own strength and to apply this power in a calculated manner, in most cases to society's benefit. Although we may not know precisely what our environment will look like 100 years from now, we can be assured that our expectations, and probably many of our needs, will be quite different from what they are now. Our basic needs will not have changed, however, and this is why the guidance provided by a Conservation Strategy would help to ensure that these needs are not forgotten or overlooked.

The maintenance of life-support systems and essential ecological processes is just as important in urban places as it is elsewhere. The stresses placed on urban environments may be slightly different from those encountered in outlying areas, but the basic human needs are the same, and the systems and processes that must be maintained rely on the same resources.

When solutions to many urban problems are being sought, the interconnectedness of resource uses and the potential for future problems are critical. For example, the problem of waste disposal is a recurring one, especially in cities, which generate vast amounts of garbage daily. Much of this waste could be recycled, reducing pressure on virgin resources and conserving energy. Although some progress has been made in encouraging recycling, landfill sites are still the final resting place for most of our wastes, and considerable effort is required to ensure that the chosen site will be environmentally safe as well as socially acceptable.

The locating of industrial activities in urban areas has advantages for individual firms, but sometimes these industries generate byproducts that can lead to long-term problems in clean-up or decontamination. As the number of new chemicals increases, it is hard for those who regulate and those who are regulated to keep up to date on safe practices. Past experience suggests that a conservative approach in such matters is the best course.

The concentration of people and industries in urban areas can also create problems related to water quality and waste treatment. None of us wants to see the deterioration of our waterways, and certainly all those who live downstream have an interest in maintaining water quality. However, this same concentration of people and industry provides an opportunity to take advantage of economies of scale, and treat such wastes efficiently and economically in modern treatment plants.

These are examples of problems that occur in urban areas but which all of us should be interested in solving. Because we can drive past a sign that says "city limits" does not mean that the influence of the city or that of the adjacent region is not felt on the other side. The links between cities and their outlying areas can be demonstrated in other ways that are also in keeping with the objectives of the World Conservation Strategy. Just as diverse ecosystems are considered to be more stable, so too are diversified economies. Whether it is a small town of 500, a metropolis of 500,000, or a province of 2,000,000, the more diverse the economic base, the better able the economy and the society will be to absorb whatever disruption or disaster comes along.

As an example, consider the classified pages of a telephone book for a large Alberta city. If you were to look under "D" for diversity, say, you would find a variety of goods and services ranging from "Dairies" and "Dairy Equipment" to "Drugs", "Dry Goods", and "Duplicating Services". Also included in this listing are things as diverse as "Dancing Schools", "Data Communications", "Dentists", "Department Stores", "Diesel Engines", "Doors", "Doughnuts", and "Drilling Equipment". This abridged list can be used to make two points:

1. Diversification of economic activities is likely to create a more stable social and economic structure. If all of the doughnut makers went out of business, the impact might be felt by the people directly involved, but the overall economic structure would be relatively undamaged, and able to

provide support for former doughnut-makers to learn how to make cakes or bagels.

2. This list suggests that although these are activities that are carried out in the city, many of them rely on resources or raw materials produced in the surrounding regions. Dairy farms and oil wells, for example, are not generally found within urban areas.

Looking more broadly at the interconnections of our society and its economic components, it can be argued that what has happened through this exchange of goods, services, and ideas is the same thing that occurs in nature: the development of a reciprocating system. Animals, plants, and entire ecosystems function through the maintenance of reciprocating systems. Maintenance of these systems is crucial to their survival because if any part of the process breaks down, the whole system will collapse; just so, maintenance of the reciprocating or exchange systems in our society are equally crucial to its survival.

Sustainable use of the urban environment has slightly different connotations from sustainable use of species and ecosystems. Rather than being a place where our very important natural, renewable resources are produced, it is a place where human resources blossom. To this end, it is important that the quality of our urban environments be maintained in a way that allows the dynamic innovation and creativity characteristic of cities to be sustained. In this way, our cities and urban areas can themselves be thought of as ecosystems that must be sustained and kept healthy to help meet specific needs of our society. Just as forests and farmland can meet a variety of our needs well into the future if they are managed on a sustainable basis, so too can our cities continue to nurture talents and human resources, which will prove equally vital to the future of Alberta society.

If the urban environment is to continue to sustain these human resources, there must be efforts to maintain it as a pleasant place to

live. We have to realize that this is more than just maintaining the roads and sewers (although this is a large task in itself); it means ensuring that our cities are clean and safe, that our air and water are clean, and that the other, less tangible needs of human beings, such as those described in Objective 4, can also be met. If our urban environments are places where people want and choose to live, then they will become truly self-sustaining. Another type of reciprocating system will have been formed in which residents will both benefit from and contribute to the vitality and viability of their community.

Conclusion

Like all other matters relating to our environment, anticipation of problems and integrated planning are of paramount importance in maintaining the quality of urban regions. But as elsewhere, problems can only be successfully resolved if there is effective and acceptable implementation of these integrated plans. Cities rely on the regions surrounding them, and people who live in cities need and use the space and materials that are available in the outlying areas. But cities also influence the lives and activities of residents throughout Alberta. Like the biosphere, healthy cities and city regions are complex, interconnected, and reciprocating systems. Without them, our quality of life and the well-being of our society would be unsustainable.

Objective 6. To use and manage our non-renewable resources in the interests of developing a long-term sustainable economy for Albertans

The World Conservation Strategy did not address the problems associated with the role of non-renewable resources in a sustainable resource use plan. Developing a Conservation Strategy for this province without an important place for the non-renewable resource sector (especially oil, gas, oil sands, heavy oil, and coal) would be ignoring

one of our most important assets. Alberta produces about 85 percent of all the crude oil produced in Canada, and Albertans recognize the special responsibilities that go with the territory. Conservation has long been recognized as an extremely important component of our energy sector. The agency most directly involved in regulating the activities of this sector is not by accident named the Energy Resources Conservation Board (emphasis added). The ERCB was established nearly 50 years ago, to "effect the conservation of, and to prevent waste of, the energy resources of Alberta."

The Economic Importance of Non-Renewable Resources

The future of the Alberta economy is inextricably linked with the fortunes of the oil, gas, coal, and oil sands industries. Despite our best efforts to diversify, and with some successes, the energy industry cannot and should not be left out of our plans for the future. The aptly named oil shocks inflicted on the oil-consuming nations in 1973 and 1979 have run their course, first presenting an unprecedented boom in the Alberta economy, and later a slower but equally impressive decline. Whatever awaits us in the future may be just as surprising.

Nearly all of the other sectors of our economy were affected by the developments in the oil and gas industry. Coal mines picked up the tempo considerably as energy substitution increased in significance; the price of farmland started on an awesome upward spiral, increasing 175 percent in constant dollars over the 1971 to 1980 period; and housing prices kept pace. The population of Alberta rose from 1.690 million in 1973 to 2.354 million in 1983 before leveling off and then declining in 1984. Each of these consequences of the energy price fluctuations has had major effects on the people of this province. There were of course other causes for the recent economic variability, but for Alberta the fortunes of the oil and gas industry, and government intrusions into the market structure of this industry, were paramount.

The Importance of Reinvesting Revenues Obtained from the Use of Non-renewable Energy Resources

The development of the renewable resources of Alberta is affected by the non-renewable energy resource industries in two ways. First, there are the environmental effects connected to the exploration, extraction, processing, transportation, and use of our non-renewable energy resources. Sometimes these environmental effects can affect the short- or long-term development capacity of the renewable resources of the province. Second, the societal investments in development of the energy resources industries in Alberta cannot be used at the same time for renewable resource development. Only by receiving a return to society on the investment in non-renewable energy development can we make other investments in sustainable, renewable resources. The Alberta Heritage Trust Fund is one such return on the investment in the non-renewable energy sector; the tremendous number and variety of skills that are developed in the people employed directly or indirectly by this sector are another.

The environmental effects of our energy industry have long been recognized by the industry itself, government, and the public. Development of the means to prevent environmental damage and to mitigate the effects of such damage where it is unavoidable has paralleled the development of the energy industry in Alberta. But the environmental effects of the oil, gas, coal, and oil sands industries remain significant. Air, land, and water are affected; our urban, rural, and wild lands are affected; wildlife and livestock, and crops and forests are affected. People in every part of Alberta are aware of the environmental presence of our largest industry.

There are few entirely benign human activities that accomplish the objectives of improving our standard of living or quality of life. Even our hunter-gatherer predecessors brought substantial changes to the environment of their time (for example, they deliberately set prairie fires). The contemporary business of raw resource extraction and use, by its nature, brings about significant changes to the environment.

Some of these changes entail serious environmental costs to Alberta. Seeking the least-cost preventive or mitigative measures that can be applied to the environmental problems tied to the extraction and use of non-renewable energy resources is a continuous task for the industry, for government, and for the public. Because it is not presently possible to prevent or avoid many of the physical changes to the environment, the people of this province must receive a fair share of the revenues from this essential industry in order to mitigate the effects of this industry on our potentially renewable resources. Making the environmental case for Alberta's share of non-renewable energy resource revenues has to be based on an honest description of the effects.

It is clearly not satisfactory to anyone to simply accept environmental damages that interfere with the development of an economy based on the sustainable use of our resources. Neither is it acceptable merely to establish a price level at which environmental damages are purchased. But realistically, tradeoffs must be made between the objectives of development and conservation, and these tradeoffs are sometimes made through monetary exchange. When this happens there is a responsibility imposed on all of us to invest that capital intelligently in a future that will be sustainable.

The National Interest

The vast majority of the known, accessible petroleum-based resources in Canada lie under the surface of Alberta. The significance of this fact will continue to intrude on the Canadian consciousness as long as these products are in demand. World supplies and demand will continue to establish the prices for oil, gas, and the products made from them, just as world markets establish the prices of wheat, automobiles, forest products, metallic minerals, textiles, shoes, steel, and the high-technology products that often affect other prices. Petroleum-based energy products are somewhat different from the rest (with the possible exception of high tech) in one fundamental way. In

our present energy system, they are the means by which all the other products are either produced, processed, or transported. Petroleum products are absolutely vital to the national interest in the same way that food is; and the food production and distribution system is perhaps more dependant on petroleum products than most other industrial sectors.

The people of Alberta have a responsibility to the rest of Canada to continue to find, produce, and process these non-renewable resources for the betterment of all Canadians. At the same time, all the people of this nation should be aware of the fact that Alberta is selling a resource that will not be replaced during the remotely foreseeable future, and at a cost in terms of other Alberta resources. We can all benefit from a Conservation Strategy that integrates the various requirements of all the important interests in the continued development and conservation of our non-renewable energy resources.

Conservation and the Development Process

Development and conservation can be applied to non-renewable resources in several ways. In the first place, we want the transition to a renewable resource based economy to be as smooth and painless as possible. One way to do that would be to extend the useful life of our economically competitive non-renewable resources, or develop equally attractive substitutes. People the world over are seeking economical substitutes for fossil fuel energy with mixed success. Given the existence of very large fossil fuel resources in Alberta, extension of the useful life of these resources is very important to our future. The life of our non-renewable energy resources can be extended in many ways.

Recycling

One of the largest recycling industries in the province is based on oil. Recycled lubricating (lube) oil has long been a significant industry in Alberta. It is estimated that a little over 50 percent of all lube oil sold is recoverable. At the present time, about 10 to 15 percent is actually recovered, but since only a small portion of our crude oil can be economically processed into lube oil, the amount recycled is significant. The oilfield-reclaiming industry is another important contributor to the extension of our non-renewable energy resources. These companies are able to collect and process oil from spills or other oil unsuitable for direct loading into the pipelines.

There are now sufficient concentrations of other non-renewable resources found in Alberta to support major industries. The recycling industries in Alberta include steel, glass, and paper. Other materials are concentrated in the province and then exported to other locations for recycling. Although some of these resources are part of a renewable resource cycle, the final product made from a renewable resource is often not readily converted back into a useful resource once used. There are also substantial losses of the resource associated with the recycling processes, but recycling is a useful and often profitable method of extending our resources through reuse.

The recycled steel industry in Alberta has grown to the point where about half the feedstock used for processing in the province is now imported. Steel from auto bodies, farmyard scrap, and railway and industrial scrap has accumulated to the point where it can be treated as if it were a partially renewable resource. Steel recycling is able to compete with the much larger steel industries in Eastern Canada by avoiding high transportation costs and concentrating on smaller products directed towards the local market.

The recycling of bottles has prevented considerable littering of roadsides and has contributed to the removal of this kind of debris if it is discarded. It has also contributed to the development of a glass

manufacturing industry based partially on recycled glass. Paper recycling results in products such as tar paper, wallboard backing, and cardboard in Alberta. Other paper is exported to the United States for recycling. Aluminum cans are now shredded and baled for export to aluminum recycling plants. Other metals are likewise collected in Alberta and sold to recyclers elsewhere.

Energy Conservation

Energy use in Canada is very high relative to other industrialized nations. For example, Canada uses 12 percent more energy per unit of domestic product than the United States, 23 percent more than the United Kingdom, and double that of West Germany, France, or Japan (Economic Council of Canada 1985). There are many reasons for this, our northern location and cold climate not the least of them. Canada is the second largest nation in the world, and has a very widely distributed population compared to other countries. The great distances involved in moving people and goods across this country are astonishing to most newcomers. But there are other, more subtle reasons for the apparent disparity in energy use per unit of output between Canada and the rest of the world.

Canada is a net exporter of energy and the many processes leading up to energy production and export are energy intensive. The raw resource extraction industries that make up a relatively large portion of Canadian industry are also energy intensive. The forest products industry, mining and metals, and agriculture each rely heavily on large energy inputs for their operations. A large portion of the product of these industries is for the export market. Thus much of the energy used in Canada is ultimately used in other countries in the form of Canadian imports (Economic Council of Canada 1985).

Since the energy price shocks that began in 1973, energy conservation, as measured by Primary Energy Consumption per Unit of Real Domestic Product, has resulted in an average annual decline of 2.8

percent in Alberta. This compares to only 1.3 percent for the nation as a whole (Economic Council of Canada 1985). This rate of conservation of energy is understandable in light of the price rise over the same period.

Conservation of energy has become a central feature of our economy over the last decade. Insulation programs, reductions in lighting, more efficient furnaces and appliances, lowered thermostats, and many other small energy-saving measures have resulted in a "reduction of some 13 percent in the average energy consumption of Canadian households" between 1973 and 1982 (Economic Council of Canada 1985). The federal government has reduced its energy consumption by 18 percent in the seven years from 1975 to 1981. The commercial sector is estimated to have reduced its energy use by 9 percent between 1973 and 1982, and the industrial sector by about 7 percent during the same period. In the transportation area, "on average, the drop in energy consumption per vehicle has been 23 percent" (Economic Council of Canada 1985).

Preserving our resources by deliberately not producing all the gas and oil that could be sold is one sure way of insuring a future supply. This is in fact being done now, but can be very costly to our present economic circumstances if carried to an extreme. Increasing the percentage of the total reserves that is recovered (for example, by increasing the scale of enhanced recovery research and practice) is another ongoing conservation technique. This is an area of great importance to our supply of fuel, and has the potential to extend the life of our conventional crude resource. New sources of oil, gas, and coal probably will be discovered in the province, but massive new discoveries are considered unlikely. Finding more efficient ways to process oil sands into crude oil, like enhanced conventional oil recovery, has the potential to greatly extend our usable resource base. Matching the source of energy to its end use, while not necessarily reducing the amount of energy used, can reduce the expense of producing it and thereby allow these savings to be invested elsewhere in the economy. Switching energy sources to more efficient, less costly, or renewable varieties is the subject of continuous research by

corporations, government institutions, and individuals. In the long run, the results of their efforts will be one of the keys to a successful sustainable future.

Conclusion

There is an established system for monitoring remaining reserves of oil and gas. The Energy Resources Conservation Board estimated in their Alberta Energy '84 report that conventional crude oil reserves would last 12 years at the level of production in 1983. However, since production capacity is expected to decline steadily, the reserves should last much longer at the reduced rates (ERCB 1985). Established conventional crude oil reserves have declined every year except one since 1969. Projections to the year 2000 are for conventional oil production to have been cut in half, despite enhanced recovery operations and new discoveries of oil (ERCB 1985).

This loss in production is predicted to be replaced by very large increases in crude bitumen and synthetic oil production (ERCB 1985). The cost of production for these latter sources is higher than for conventional sources in Alberta, so the net revenues will be relatively smaller than would be the case with conventional oil, regardless of price. Whether there are absolute reductions or increases in income from oil depends on the price received, but the margin is less for the oil sands and heavy oil than from the light-medium mix of conventional oil we presently produce.

Whatever the fortunes of the non-renewable resource sector, there will continue to be a gradual transformation of our economy to one based on the use of economically renewable resources. This is not to imply that non-renewable resources will decrease in importance. Recycling, reuse, increased durability, repairability, and conservation of products made from many essential non-renewable resources will probably increase in significance as new sources become relatively more expensive to find, extract, and process. The primary purpose of an

Alberta Conservation Strategy is to help us anticipate and prepare for that inevitable future before it arrives.

CONCLUSION

This document represents the first step in the development of a Conservation Strategy for Alberta. Its main purpose is to encourage all Albertans to think about the quality of life that they now enjoy and to consider what sort of physical, economic, and cultural environment they would like to leave for their children. In the end, most people want the best possible life and lifestyle for themselves and their families. Many of the ideas presented in this document focus on societal well-being, and because the objectives and recommendations of the World Conservation Strategy provide for satisfying the basic needs of all people, the Strategy enhances the prospects for social stability and peace on a global basis.

It should be clear by now that it is impossible to separate the ideas and goals of conservation and development; each depends upon the other, and both are necessary to maintain and enhance our well-being in every sense. It should also be apparent that the goal of sustainable development is not only desirable, but in the long term it is essential if we and our fellow species on planet Earth are to survive. Unless resources are used so that their benefits can be enjoyed just as much in the future as at present, and unless the environment remains healthy and productive, the capacity of a province or a nation to meet the needs of its people will progressively diminish. Cooperation and conciliation are the keys to development and successful implementation of a conservation strategy. When the objectives and goals are explicitly stated and plans for achieving them are discussed, those who perceived themselves as opponents will find that they agree on far more points than they disagree on.

The World Conservation Strategy provides an intellectual framework and practical guidance for the development of a Conservation Strategy for Alberta. It is flexible enough to accommodate regional differences yet broad enough to provide the basic principles for a sound structure. A conservation strategy based on the principles discussed in this Prospectus would consist of many parts that ultimately will fit

together in a complete package to provide guidance to business, government, industry, education, and environmental interests. However, the process of developing a Conservation Strategy for Alberta will be as important as the document itself. Because the document should be dynamic and subject to review and modifications as conditions and priorities change, the process of preparation and implementation also will be continual. Participation and collaboration are therefore essential at all stages. Furthermore, the purpose is not only to produce a strategy, but at the same time to achieve throughout the population a level of understanding and knowledge of the interdependence of conservation and development.

Development that is inflexible and little influenced by ecological considerations is unlikely to make the best use of available resources and may cause economic as well as ecological and social damage. The most effective way for society to avoid such problems is to integrate every stage of the conservation and development processes, from the initial setting of policies to their eventual implementation. If the objectives of conservation are to be achieved, governments need to dispel any notion that conservation is a limited, independent sector largely concerned with wildlife or soil, and that ecological factors are impediments to development that may be safely overlooked or merely considered on a project-by-project basis rather than as matters of policy.

Many agencies and individuals whose task it is to manage our resources have been encouraged to be more concerned with production than with maintenance or conservation. In particular, agencies charged with both regulating and promoting resource development are likely to find it difficult to balance these two requirements. This is due at least in part to the lack of a well-defined, generally agreed upon measure of conservation performance. Economic performance is measured in many ways, all of them couched in monetary terms: employment; gross domestic product; yields of timber, grain, and other commodities; and so on. As a result, the costs of conservation and of measures to enhance our quality of life in other ways might appear to outweigh the

benefits, since the costs can be calculated in immediate dollars and cents while the benefits tend to be more intangible and are realized in the future. In addition, the costs and benefits of conservation and development have tended not to be borne by the same segments of our society, and this further complicates the task of calculating them. At a time when all of us are aware of and concerned with economic indicators, it is important that the benefits of conservation be quantified in terms that can be easily understood and acknowledged.

Much of our present well-being is due to a fortuitous combination of factors that resulted in a rich heritage of resources; our fertile agricultural soils, large forests, and extensive petroleum reserves are all legacies of nature, so that our capacity for sustainable use and development has not been truly tested. Another advantage is that the pressure for massive, rapid development has been relatively low. This provides us with a wonderful opportunity which we, as responsible people, ought not to ignore. Albertans know their province best; we have the expertise and we have been given the lead time to choose the direction we want to take.

The Public Advisory Committees to the Environment Council of Alberta will be preparing a draft Provincial Conservation Strategy as one of their major projects for 1986. If present plans are fulfilled, it is hoped that public hearings will be held on the topic of a Conservation Strategy for Alberta following the completion of the working paper by the Public Advisory Committees. Such hearings would allow public comment and discussion on a matter that will affect in some way the life of every Albertan. After reading this Prospectus, you may have some ideas about things you think should be addressed in a Conservation Strategy for Alberta; for example, what do you think are the most important issues relevant to achieving the goal of sustainable development in our province? How do you see our problems in relation to the objectives outlined in Chapter 4? How can we best meet these objectives and what are the impediments? How can these impediments be overcome?

We welcome your comments. Please write to the Steering Committee for the Conservation Strategy c/o The Environment Council of Alberta at the address given on the title page of this document. The Environment Council's phone number is also given on the title page.

Preparation of a Conservation Strategy for Alberta is an important undertaking. Not only will it be a document that will influence the future of our province but, just as importantly, it will set a standard for the resolution of future problems and conflicts. Because of this, all segments of society will need to be involved in its preparation, just as they were with preparation of the World Conservation Strategy. There are already reliable structures and procedures in place in Alberta for obtaining public input and establishing consensus on issues relating to conservation and development. Our government and our population in general have a great deal of practical knowledge and expertise on matters that are crucial to the preparation of a Conservation Strategy. This is an opportunity to have a lasting and positive influence on the future of our province and it should not be passed by.

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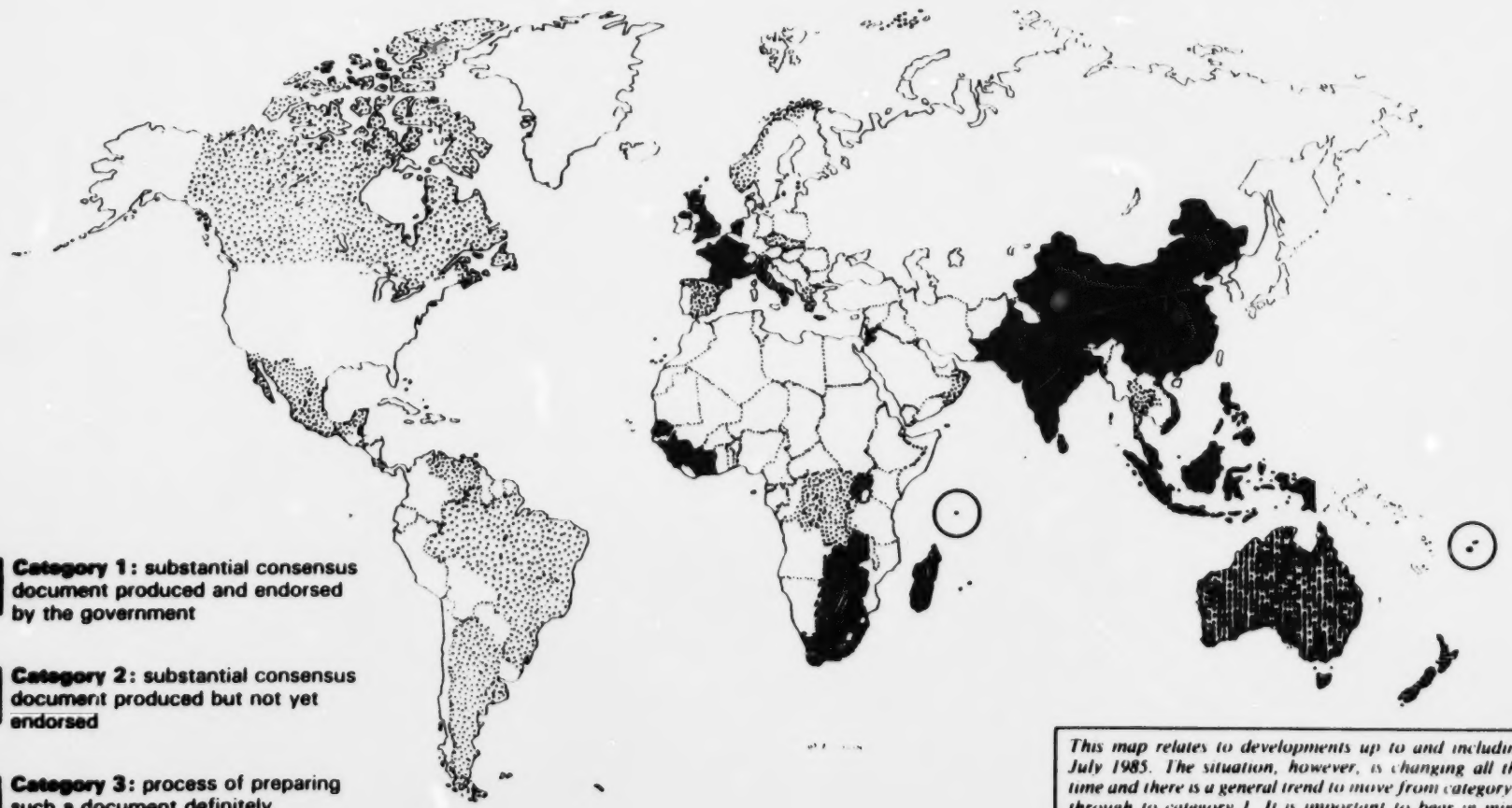
APPENDIX A. DEVELOPMENT OF NATIONAL CONSERVATION STRATEGIES AROUND THE WORLD



Category 1: substantial consensus document produced and endorsed by the government

Category 2: substantial consensus document produced but not yet endorsed

Category 3: process of preparing such a document definitely happening

Category 4: course of action initiated which looks likely to lead to an NCS

Category 5: other involvement (WCS officially endorsed/evolution of an NCS at exploratory stage/strategic planning for resource management at sub-national level

This map relates to developments up to and including July 1985. The situation, however, is changing all the time and there is a general trend to move from category 5 through to category 1. It is important to bear in mind that the evolution of an NCS involves a diverse set of processes, with different countries responding in radically different ways, so they cannot always be summarised in a map of this kind. It does, nevertheless, give an overall indication of NCS development around the world.

Source: *World Conservation Strategy In Action* 1985